BMP Pilot Studies

Quarterly Status Report No. 5

BMP Pilot Projects in District 7 and District 11

CTSW-RT-99-085 June 15, 1999

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INTRODUCTION

Background and Purpose

Periodic status reports and meetings are specified in the District 7 and District 11 Scoping Study as a vehicle to update NRDC, EPA, San Diego Baykeeper, and Santa Monica Baykeeper on the progress of the BMP Retrofit Pilot Program and receive input as to appropriate changes or modifications to the program. The bi-weekly and quarterly status meetings have been scheduled on a regular basis to coincide with general project milestones and periods of significant activity. Approximate scheduled dates for the periodic status meetings are given in the Scoping Study. This report provides background documentation for the fifth status meeting to be held on June 29, 1999.

The scope of the status reports includes a general program-level overview of the activities that precede the status meetings. Status reports include information regarding the Pilot Program 1) remaining designs, 2) remaining construction, 3) first year of operation, maintenance, and monitoring program, 4) program costs, and 5) vector and environmental issues. Each of these topics will be addressed as the information becomes available over the scheduled course of the BMP Retrofit Pilot Program. The program Master Schedule is contained in the Scoping Study for each District.

The preceding Status Meeting (No. 4) was held on March 11, 1999. The meeting minutes are provided in Appendix A. The main issues discussed at Status Meeting No. 4 include the following:

- Construction status for each District
- Status of the OMM Plans/Maintenance Indicator Document
- Status of Vector Control Agreements
- Status of Remaining Design in District 7
- Specific Issues:

La Costa Infiltration Basin Background Investigation Report
Carlsbad MS Infiltration Trench Issues
Condition of the Biofiltration Swales and Strips
Drain Inlet Inserts Flow Bypass
Water Quality Sampling for the Remainder of the Season

QUARTERLY STATUS REPORT SUMMARY

Location	BMP Type	Site ID	Monitoring Consultant	Design Phase	Construction Phase	Instrumentation Phase	Monitoring Phase
DISTRICT 7							
I-605/SR-91	IB	73101	MW/Law				X
I-210 East of Orcas	CDS	73102	MW/Law	X			
I-210 East of Filmore	CDS	73103	MW/Law	X			
I-5/I-605	EDB	74101	BC				X[2]
I-605/SR-91	EDB	74102	BC				X[2]
Paxton Park & Ride	MF	74103	BC	X			
Metro MS	MCTT	74104	BC	X			
Alameda MS	OWS	74201	BC				X
Eastern MS	MF	74202	BC				X[2]
Foothill MS	MF	74203	BC				X[2]
Termination Park & Ride	MF	74204	BC				X[2]
Via Verde Park & Ride	MCTT	74206	BC				X[2]
Lakewood Park & Ride	MCTT	74208	BC				X[2]
Altadena	Bio Strip/IT	73211a,b	MW/Law				X[1]
Foothill	DII	73216	MW/Law				X
LasFlores	DII	73217	MW/Law				X
Rosemead	DII	73218	MW/Law				X
I-605/SR-91	Bio Strip/Swale	73222a,b	MW/Law				X[1]
Cerritos MS	BioSwale	73223	MW/Law				X[1]
I-5/I-605	BioSwale	73224	MW/Law				X[1]
I-605/ Del Amo	BioSwale	73225	MW/Law				X[1]
DISTRICT 11							
I-5/SR-56	EDB	111101	KLI				X[2]
I-15/SR-78	EDB	111102	KLI				X[2]
I-5/La Costa (West)	IB	111103	KLI	Currently under investigation			
I-5/La Costa (East)	WB	111104	KLI		X		
I-5/Manchester (East)	EDB	111105	KLI		X		
Kearney Mesa MS	MF (Comp)	112201	KLI				X
Escondido MS	MF	112202	KLI				X
La Costa Park & Ride	MF	112203	KLI				X
SR-78/I-5 Park & Ride	MF	112204	KLI				X
Melrose Ave/SR-78	Bio Swale	112205	KLI				X[1]
I-5 Palomar Airport Road	Bio Strip	112206	KLI		X		
Carlsbad MS	Bio Strip/IT	112207a,b	KLI				X[1]

1 Waiting for biofilter to achieve required coverage per OMM plan.
2 Sites with Area Velocity Bubblers (AVBs) – monitoring equipment [redacted]

BMP STATUS AND ACTIVITIES

District 7 BMP Pilot Sites

I-605/SR-91 Interchange Infiltration Basin (Site ID 73101) MW/Law

Construction

Construction was completed on April 9, 1999. Activities this quarter include regrading/retilling of the basin invert and construction of the pipe extension and headwall. The basin was hydroseeded.

Stormwater Monitoring

No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operations and Maintenance

None (Recently deemed ready for monitoring)

Vector Activities

Agreement with Greater LA County Vector Control District was executed the week of May 31. Monitoring by GLACVCD at the beginning of June showed that the overflow control structure contained standing water.

Issues / Solutions

None

I-210/East Orcas Avenue Continuous Deflection Separators (Site ID 73102)

I-210/East of Filmore Street Continuous Deflection Separators (Site ID 73103)

Status

Plans and specifications are currently being updated to Caltrans standards to meet PS&E process. Expenditure authorization number to begin process.

Vector Activities

Agreement with Greater LA County Vector Control District was executed the week of May 31.

Schedule

Preliminary Design/Construction Schedule for CDS Units – PS&E Process

Activity	Schedule	Duration (calendar weeks)
Obtain EA	06/01/99	
Begin Clearance	06/21/99	
Obtain District Clearances/to HQ	07/19/99	4
HQ Ready to List (Advertise)	09/13/99	8
Bid Opening	10/11/99	4
Award Contract	11/08/99	4
Begin Construction	11/08/99	4
Complete Construction (30 wkdays)	12/20/99	6
Fully Operational	01/03/00	2

I-5/I-605 Extended Detention Basin Lined (Site ID 74101) BC

Construction

Site is complete and operational. Activities this quarter include installation of metal beam guard rail, handling of minor punch list items, and extension of the service/access road (estimated 3 week effort). The start date for the extension of the access road was May 24, 1999, with a construction period of approximately 3 weeks.

Stormwater Monitoring

Three storms have been sampled to date (March 25, April 6, and April 11, 1999). Stormwater monitoring/sampling will resume beginning October 1. See Appendix B for D7 Summary Report of the first year of monitoring.

Operations and Maintenance

Conducted monthly maintenance inspection; no problems noted.

Vector Activities

Service agreement between Brown and Caldwell and Greater LA County Vector Control District was executed on May 13, 1999. Vector activity was noted on 2/22 and 2/23; VCD was notified. UCR personnel noted vector activity at this site (April 20). Egg rafts were collected on 4/20. During the week of 5/31, GLACVCD treated dense populations of mosquito pupae with Golden Bear™ oil.

Issues / Solutions

None

I-605/SR-91 Extended Detention Basin – Unlined (Site ID 74102) BC

Construction Activities

Construction was completed on March 26, 1999. Activities this quarter include the installation of metal beam guard rail, extension of asphalt access road, and handling of minor punchlist items.

Stormwater Monitoring

Three storms have been sampled to date (March 25, April 6, and April 11, 1999). Stormwater monitoring/sampling will resume beginning October 1. See Appendix B for D7 Summary Report of the first year of monitoring.

Operations and Maintenance

Conducted monthly maintenance inspection; no problems noted.

Vector Activities

Service agreement between Brown and Caldwell and Greater LA County Vector Control District was executed on May 13, 1999. Monitoring by GLACVCD at the beginning of June showed that the BMP contained standing water; however, no standing water is present currently. No vector activities have been noted by the OMM crew.

Issues / Solutions

None

Paxton Maintenance Station Media Filter (Site ID 74103)

Metro Maintenance Station Multi-Chamber Treatment Train (Site ID 74104)

Status

Reformat plans and specifications to meet Caltrans standards. Prebid review by the District continues. Project is being processed as PS&E.

Vector Activities

Service agreement between Brown and Caldwell and Greater LA County Vector Control District was executed on May 13, 1999.

Schedule

Design/Construction Schedule for Metro MS MCTT		
Activity	**Schedule**	**Duration (calendar weeks)**
Obtain EA	06/01/99	
Begin Clearance	06/28/99	
Obtain District Clearances/to HQ	07/26/99	4
HQ Ready to List (Advertise)	12/13/99	20
Bid Opening	01/10/99	4
Award Contract	02/07/99	4
Begin Construction	03/06/00	4
Complete Construction (80 wkdys)	06/26/00	16
Fully Operational	07/10/00	2

Design/Construction Schedule for Paxton PR Media Filter		
Activity	**Schedule**	**Duration (calendar weeks)**
Obtain EA	06/01/99	
Begin Clearance	06/28/99	
Obtain District Clearances/to HQ	07/26/99	4
HQ Ready to List (Advertise)	12/13/99	20
Bid Opening	01/10/99	4
Award Contract	02/07/99	4
Begin Construction	03/06/00	4
Complete Construction (80 wkdys)	06/26/00	16
Fully Operational	07/10/00	2

Alameda Maintenance Station Oil/Water Separator (Site ID 74201)

Construction Activities

Construction was completed on May 26, 1999. Construction activities this quarter include installation of the tank, drain grates, and fencing, and handling of minor punch list items.

Stormwater Monitoring

Instrumentation complete. No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operations and Maintenance

None (Recently deemed ready for monitoring).

Vector Activities

Service agreement between Brown and Caldwell and Greater LA County Vector Control District was executed on May 13, 1999. Monitoring by GLACVCD at the beginning of June showed that standing water was present near the measuring device; no breeding was observed

Issues / Solutions

None

Eastern Maintenance Station Media Filter (Site ID 74202)

Construction Activities

Construction was completed on March 26, 1999.

Stormwater Monitoring

Two storms have been sampled to date (April 6 and April 11, 1999). Stormwater monitoring/sampling will resume beginning October 1. See Appendix B for D7 Summary Report of the first year of monitoring.

Operations and Maintenance

Conducted monthly maintenance inspection; no problems noted.

Vector Activities

Service agreement between Brown and Caldwell and Greater LA County Vector Control District was executed on May 13, 1999. Monitoring by GLACVCD at the beginning of June showed that the BMP contained standing water at the pump wet well area; however, no standing water is present currently. Installation of screens to minimize vector activity is scheduled to be complete by mid-June.

Issues / Solutions

None

Foothill Maintenance Station Media Filter (Site ID 74203)

Construction Activities

Construction was completed on March 26, 1999.

Stormwater Monitoring

Three storms have been sampled to date (March 25, April 6 and April 11, 1999). Stormwater monitoring/sampling will resume beginning October 1. See Appendix B for D7 Summary Report of the first year of monitoring.

Operations and Maintenance

Conducted monthly maintenance inspection; no problems noted.

Vector Activities

Service agreement between Brown and Caldwell and San Gabriel Valley Vector Control District was executed on May 7, 1999. Visits have been conducted by the VCD; standing water and algal growth have been observed in the sediment vault. Screens have been installed to minimize vector activity. Requests have been made for ladders into the media filter chambers for obtaining samples. Brown and Caldwell is working on installing a ladder.

Issues / Solutions

None

Termination Park and Ride Media Filter (Site ID 74204)

Construction Activities

Construction was completed on May 26, 1999. Construction activities this quarter include installation of the precast vaults, utility work, and fencing, and handling of minor punch list items. A summary of costs and estimated change orders are provided on Page 36.

Stormwater Monitoring

Instrumentation complete. No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operations and Maintenance

None

Vector Activities

Service agreement between Brown and Caldwell and Greater LA County Vector Control District was executed on May 13, 1999. GLACVCD visited the site the week of 5/17; a large amount of mosquito pupae were observed and treated with Golden Bear™ oil. Installation of screens to minimize vector activity is scheduled to be complete by mid-June. Brown and Caldwell is looking at the possibility of installing a ladder at the media filter chambers for vector sampling (and maintenance).

Issues / Solutions

None

Via Verde Park and Ride Multi Chamber Treatment Train (Site ID 74206)

Construction Activities

Construction was completed on May 28, 1999. Construction activities this quarter include installation of precast vaults, sand filter, and fencing, and handling of minor punch list items. See summary of construction costs and change orders on Page 36.

Stormwater Monitoring

Instrumentation complete. No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operations and Maintenance

None

Vector Activities

Service agreement between Brown and Caldwell and San Gabriel Valley Vector Control District was executed on May 7, 1999. Visits have been conducted by the VCD. Requests have been made for ladders into the MCTT chambers for obtaining samples. Brown and Caldwell is working on installing a ladder. Installation of screens to minimize vector activity is scheduled to be complete by mid-June.

Issues / Solutions

None

Lakewood Park and Ride Multi Chamber Treatment Train (Site ID 74208)

Construction Activities

Construction is scheduled for completion on June 4, 1999 (minor punchlist items remaining). Site has been considered operational since May 7, 1999. Construction activities this quarter include installation of precast vaults, utility work, and fencing, and handling of minor punchlist items. See summary of construction costs and change orders on Page 36.

Stormwater Monitoring

Instrumentation complete. No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operations and Maintenance

None

Vector Activities

Service agreement between Brown and Caldwell and Greater LA County Vector Control District was executed on May 13, 1999. During the week of 5/17, mosquito larvae were found in the sump well and treated with Vectolex™. During the week of 5/31, dense populations of mosquito pupae were treated with Golden Bear™ oil. Brown and Caldwell is looking at the possibility of installing a ladder at the MCTT chambers for vector sampling (and maintenance). Installation of screen to minimize vector activity is scheduled to be complete by mid-June.

Issues / Solutions

None

Altadena Maintenance Station Bio-Strip and Infiltration Trench (Site ID 73211 a, b)

Construction Activities

Construction was completed on March 12, 1999. No additional work was performed since the last quarterly status report. Site was not deemed operational due to inadequate coverage of salt grass at the biofiltration strip.

Stormwater Monitoring

Instrumentation complete. No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operations and Maintenance

None

Vector Activities

Service agreement between Montgomery Watson and Greater LA County Vector Control District was executed week the of May 31, 1999. Monitoring by GLACVCD at the beginning of June showed that the spreader ditch upstream of the bio-strip contained standing water.

Issues / Solutions

The site is not operational – saltgrass coverage requirement not yet achieved. Saltgrass coverage is about 40%; irrigation will continue. See Appendix H for additional information relative to the condition of the sod.

Foothill Maintenance Station Drain Inlet Insert (StreamGuard and Fossil Filter Inserts) Site ID 73216 a, b

Construction Activities

Construction was completed on January 8, 1999.

Stormwater Monitoring

Four storms have been sampled to date (Jan 25, March 25, April 6 and April 12, 1999). Stormwater monitoring/sampling will resume beginning October 1. See Appendix B for D7 Summary Report of the first year of monitoring.

Operations and Maintenance

Per the OMM Plan, the drain inlet inserts (Fossil Filters and StreamGuard inserts) have been replaced (on March 24, April 8, and April 12). The drain inlet inserts were inspected on May 4, May 10, and May 17.

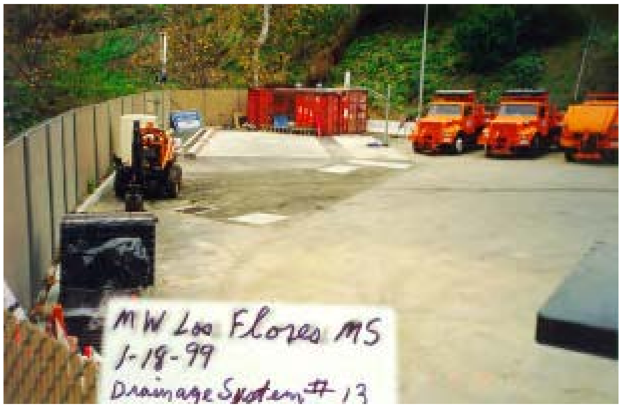
Vector Activities

Service agreement between Montgomery Watson and San Gabriel Valley Vector Control District was executed the week of May 31, 1999. Visits have been conducted by the VCD. The flume housings were observed to retain some water, but no vector breeding has been observed.

Issues / Solutions

The drain inlet inserts were determined to have problems with flow bypass (Fossil Filter) and effectiveness (Streamguard). MW has been directed by Caltrans and the Plaintiffs to research other types of inserts. Research continues on the alternate insert type for the drain inlets.

Las Flores Maintenance Station Drain Inlet Insert (StreamGuard and Fossil Filter Inserts) Site ID 73217 a, b



Construction Activities

Construction was completed on January 8, 1999.

Stormwater Monitoring

Five storms have been sampled to date (Jan 25, Jan 31, March 25, April 6 and April 12, 1999). The validity of storm samples obtained at the Fossil Filter sites prior to March 25 are under review. Stormwater monitoring/sampling will resume beginning October 1. See Appendix B for D7 Summary Report of the first year of monitoring.

Operations and Maintenance

Per the OMM Plan, the drain inlet inserts (Fossil Filters and StreamGuard inserts) have been replaced (on March 24, April 8, and April 12). The drain inlet inserts were inspected on May 4, May 10, and May 17. Debris was removed from the Fossil Filter on May 17.

Vector Activities

Montgomery Watson is in the process of negotiating a service agreement with Los Angeles County West Vector Control District.

Issues / Solutions

The drain inlet inserts were determined to have problems with flow bypass (Fossil Filter) and effectiveness (Streamguard). MW has been directed by Caltrans and the Plaintiffs to research other types of inserts. Research continues on the alternate insert type for the drain inlets.

Rosemead Maintenance Station Drain Inlet Insert (StreamGuard and Fossil Filter Inserts) Site ID 73218 a, b

Construction Activities

Construction was completed on January 8, 1999.

Stormwater Monitoring

Five storms have been sampled to date (Jan 31, Feb 9, March 25, April 6 and April 12, 1999). The validity of storm samples obtained at the Fossil Filter sites prior to March 25 are under review. Stormwater monitoring/sampling will resume beginning October 1. See Appendix B for D7 Summary Report of the first year of monitoring.

Operations and Maintenance

Per the OMM Plan, the drain inlet inserts (Fossil Filters and StreamGuard inserts) have been replaced (on March 24). Drain inlet inserts were inspected on May 4, May 10, and May 17. Debris was removed from the Fossil Filter on May 4 and May 17.

Vector Activities

Service agreement between Montgomery Watson and San Gabriel Valley Vector Control District was executed the week of May 31, 1999. Visits have been conducted by the VCD. The flume housings were observed to retain some water, but no vector breeding has been observed.

Issues / Solutions

The drain inlet inserts were determined to have problems with flow bypass (Fossil Filter) and effectiveness (Streamguard). MW has been directed by Caltrans and the Plaintiffs to research other types of inserts. Research continues on the alternate insert type for the drain inlets.

I-605/SR-91 Interchange Bio Strip & Swale (Site ID 73222 a, b) MW/Law

Construction Activities

Construction was completed on March 12, 1999. No additional work was performed since the last quarterly status report. Site was not deemed operational due to inadequate coverage of salt grass at the biofiltration strip and swale.

Stormwater Monitoring

Instrumentation not complete. No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operations and Maintenance

None

Vector Activities

Service agreement between Montgomery Watson and Greater LA County Vector Control District was executed the week of May 31, 1999. During the week of 5/31, mosquito larvae at the site were treated with Vectolex™ (see Page 42 for description). Vector activity was noted on 3/11; the VCD was notified.

Issues / Solutions

Monitoring equipment installed except for Teflon tubing. Tubing will not be installed until site is declared operational (once saltgrass coverage is achieved). Saltgrass coverage for Strip is near 90%, coverage for swale is about 70%. Irrigation will continue. For additional saltgrass information, see Appendix H.

Cerritos Maintenance Station Bio Swale (Site ID 73223)

Construction Activities

Construction was completed on March 12, 1999. No additional work was performed since the last quarterly status report. Site was not deemed operational due to inadequate coverage of salt grass at the biofiltration swale.

Stormwater Monitoring

Instrumentation not complete. No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operations and Maintenance

None

Vector Activities

Service agreement between Montgomery Watson and Greater LA Vector Control District was executed the week of May 31, 1999. Monitoring by GLACVCD at the beginning of June showed that the energy dissipater contained standing water. UCR personnel have previously noted vector activities at this site (Feb and Mar); the VCD was notified.

Issues / Solutions

Monitoring equipment installed except for Teflon tubing. Tubing will not be installed until site is declared operational (once saltgrass coverage is achieved). Saltgrass coverage is about 30%. Coverage to be supplemented by plugging of additional plant material. Irrigation will continue. For additional saltgrass information, see Appendix H.

I-5/I-605 Bio Swale (Site ID 73224)

Construction Activities

Construction was completed on March 12, 1999. No additional work was performed since the last quarterly status report. Site was not deemed operational due to inadequate coverage of salt grass at the biofiltration swale.

Stormwater Monitoring

Instrumentation not complete. No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operations and Maintenance

None

Vector Activities

Service agreement between Montgomery Watson and Greater LA Vector Control District was executed the week of May 31, 1999. During the week of 5/31, dense populations of mosquito pupae were treated with Golden Bear™ oil. UCR personnel previously noted vector activity at this site (April 20). Egg rafts were collected on 4/20.

Issues / Solutions

Monitoring equipment installed except for Teflon tubing. Tubing will not be installed until site is declared operational (once saltgrass coverage is achieved). Saltgrass coverage less than 20%. Coverage to be supplemented by plugging of additional plant material. Irrigation to continue. For additional saltgrass information, see Appendix H.

I-605/Del Amo Bio Swale (Site ID 73225)

Construction Activities

Construction was completed on March 12, 1999. No additional work was performed since the last quarterly status report. Site was not deemed operational due to inadequate coverage of salt grass at the biofiltration swale.

Stormwater Monitoring

Instrumentation not complete. No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operations and Maintenance

None

Vector Activities

Service agreement between Montgomery Watson and Greater LA County Vector Control District was executed the week of May 31, 1999. Monitoring by GLACVCD at the beginning of June showed that the energy dissipater contained standing water. During the week of 5/31, Vectolex™ was used to treat mosquito larvae at the site.

Issues / Solutions

Monitoring equipment installed except for Teflon tubing. Tubing will not be installed until site is declared operational (once saltgrass coverage is achieved). Saltgrass coverage is less than 20%. Coverage to be supplemented by plugging of additional plant material. Irrigation will continue. For additional saltgrass information, see Appendix H.

District 11 BMP Pilot Sites

I-5/SR-56 Extended Detention Basin (Site ID 111101) RBF/KLI


Construction Activities

Construction was completed on December 31, 1998. May 1999: The debris screen at the top of the water quality riser trash rack was installed per the contract plans. The canal gate was installed. BMP performance and monitoring were not influenced by the post construction/wet season installations.

Stormwater Monitoring

Four storms have been sampled to date (Jan 25, Feb 5, March 25, April 7). Stormwater monitoring/sampling will resume beginning October 1. See Appendix C for D11 Summary Report of the first year of monitoring

Operations and Maintenance

KLI, together with Martha Blane, visited the site on May 14 and assessed the condition of vegetation at the site. It was decided that the weeds will be cut to 8 inches in mid-June.

Weekly inspections were performed during the wet season (no major problems noted). Per direction of the OMM Plan, KLI has switched from weekly site inspections to monthly site inspections. Site inspections will occur the first week of every month.

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999. On May 12, KLI met with Mike Devine and Keith MacBarron of the County of San Diego Vector Control to visit the BMP. During the visit, mouse droppings were found at the effluent pipe. Vector Control suggested that if KLI cleans the pipes in front of the effluent flume, crews should wear HEPA filters to avoid possible exposure to the Hunta Virus. It should be noted that this requirement is relative to maintenance of the sampling equipment and is not typical of BMP normal maintenance.

Issues / Solutions None

SR-78/I-15 Extended Detention Basin (Site ID 111102)

Construction Activities

Construction was completed on December 31, 1998. May 1999: The debris screen at the top of the water quality riser trash rack was installed per the contract plans. The canal gate was installed. BMP performance and monitoring were not influenced by the post construction/wet season installations.

Stormwater Monitoring

Four storms have been sampled to date (Jan 25, Feb 5, March 25, April 7). Stormwater monitoring/sampling will resume beginning October 1. See Appendix C for D11 Summary Report of the first year of monitoring.

Operations and Maintenance

KLI and Martha Blane visited the site on May 14 to assess the condition of vegetation at the BMP site. It was decided that weeds over 18 inches will be removed in mid-June.

Weekly inspections were conducted during the wet season. Per direction of the OMM Plan, KLI has switched from weekly site inspections to monthly site inspections. Site inspections will occur the first week of every month.

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999. On May 12, KLI met with Mike Devine and Keith MacBarron of the County of San Diego Vector Control to visit the BMP.

Issues / Solutions

Equipment problems caused unsuccessful sampling during the April 12th event. The problem has been resolved through consultation with the sampling equipment manufacturer.

I-5/La Costa Avenue Infiltration Basin (Site ID 111103)

Construction Activities

Construction was completed on December 23, 1998.

Stormwater Monitoring

Site suspended from water quality monitoring. Groundwater elevation monitoring continues.

Operations and Maintenance

Operation of site suspended.

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999. Mosquitoes and signs of midge activity have been observed at the site. Altosid briquettes and mosquito fish have been used to treat the site twice this quarter.

Issues / Solutions

Groundwater level monitoring log is attached in Appendix F

Woodward Clyde is currently performing the siting and design review of the site. The study is scheduled for completion the 2nd week of June, 1999.

I-5/La Costa Wet Basin (Site ID 111104)

Construction Activities

Construction began on April 14, 1999. Completion date is scheduled for June 25. Remaining activites include installation of inlet/outlet hatches and miscellaneous concrete work. A summary of costs and estimated change orders are provided on Page 38.

Stormwater Monitoring

Regarding, monitoring, KLI is currently working with RBF on how to monitor flow at the effluent of the basin to address potential backwater conditions in the pipe.

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999.

Issues / Solutions

None

I-5/Manchester Avenue (Site ID 111105)

Construction Activities

Construction began on April 8, 1999. Completion date is scheduled for June 25. Remaining activities include finishing of landscaping and hydroseeding. A summary of costs and estimated change orders are provided on Page 38.

Stormwater Monitoring

No monitoring to date.

Operations and Maintenance

None

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999.

Issues/Solutions

Plant establishment is approximately 60 working days. See page 38 for construction costs and list of change orders.

Kearney Mesa Maintenance Station Media Filter– Perlite/Zeolite (Site ID 112201)

Construction Activities

Construction was completed on February 26, 1999.

Stormwater Monitoring

Three storms have been sampled to date (March 25, April 7, and April 11, 1999). Stormwater monitoring/sampling will resume beginning October 1. See Appendix C for D11 Summary Report of the first year of monitoring.

Operations and Maintenance

Per direction of the OMM Plan, KLI has switched from weekly site inspections to monthly site inspections. Site inspections will occur the first week of every month.

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999. On May 12, KLI met with Mike Devine and Keith MacBarron of the County of San Diego Vector Control to visit the BMP.

Issues / Solutions

None

Escondido Maintenance Station Media Filter –Sand (Site ID 112202)

Construction Activities

Construction was completed on February 26, 1999.

Stormwater Monitoring

Three storms have been sampled to date (March 25, April 7, and April 11, 1999). Stormwater monitoring/sampling will resume beginning October 1. See Appendix C for D11 Summary Report of the first year of monitoring.

Operations and Maintenance

Per direction of the OMM Plan, KLI has switched from weekly site inspections to monthly site inspections. Site inspections will occur the first week of every month. No problems have been noted.

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999. On May 12, KLI met with Mike Devine and Keith MacBarron of the County of San Diego Vector Control to visit the BMP. KLI has directed field crews not to dewater the standing water in the pre-sedimentation basin. The County of San Diego Vector Control has been advised to sample the site.

Issues / Solutions

None

La Costa Park and Ride Media Filter –Sand (Site ID 112203)

Construction Activities

Construction was completed on March 1, 1999.

Stormwater Monitoring

Three storms have been sampled to date (March 25, April 7, and April 11, 1999). Stormwater monitoring/sampling will resume beginning October 1. See Appendix C for D11 Summary Report of the first year of monitoring.

Operations and Maintenance

Per direction of the OMM Plan, KLI has switched from weekly site inspections to monthly site inspections. Site inspections will occur the first week of every month. No problems have been noted.

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999. Vector activity was noted in standing water on 4/27. On May 12, KLI met with Mike Devine and Keith MacBarron of the County of San Diego Vector Control to visit the BMP. One midge was captured.

Issues / Solutions

Two nests with eggs (Killdeer) were discovered at the site. During the nesting period it was recommended that crews enter the facility from the northern gate to avoid disturbing the nest. The biologists have confirmed that the nests are no longer occupied. See the Environmental Issues Section for more details.

SR-78/I-5 Park and Ride Media Filter - Sand (Site ID 112204)

Construction Activities

Construction was completed on March 3, 1999.

Stormwater Monitoring

Three storms have been sampled to date (March 25, April 7, and April 11, 1999). Stormwater monitoring/sampling will resume beginning October 1. See Appendix C for D11 Summary Report of first year of monitoring.

Operations and Maintenance

Per direction of the OMM Plan, KLI has switched from weekly site inspections to monthly site inspections. Site inspections will occur the first week of every month. No problems have been noted.

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999. On May 12, KLI met with Mike Devine and Keith MacBarron of the County of San Diego Vector Control to visit the BMP. Signs of midge breeding activity have been noted, but no treatment has been recommended.

Issues / Solutions

None

Melrose Ave/SR-78 Bio Swale (Site ID 112205)

Construction Activities

Construction was completed on February 26, 1999. No additional work was performed since the last quarterly status report. Site was not deemed operational due to inadequate coverage of salt grass at the biofiltration swale.

Stormwater Monitoring

No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operations and Maintenance

KLI and Martha Blane visited the site on May 14 to assess the condition of vegetation at the site. It was decided that all non-grasses will be weeded and organic debris (i.e., leaves and acorns) will be removed in mid-June.

Site was inspected weekly during the wet season. Per direction of the OMM Plan, KLI has switched from weekly site inspections to monthly site inspections. Site inspections will occur the first week of every month.

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999. On May 12, KLI met with Mike Devine and Keith MacBarron of the County of San Diego Vector Control to visit the BMP.

Issues / Solutions

No samples will be taken until sod attains the required coverage. Current coverage is about 50%, though sod that remains dormant has a greater coverage area. Irrigation will continue. See Appendix H for additional sod information.

I-5 Palomar Airport Biofiltration Strip (Site ID 112206)

Construction Activities

Construction is scheduled for completion on June 30, 1999. Construction activities this quarter include grading, construction of concrete swale, and installation of guard rail. Remaining task is the installation of the saltgrass sod. Sod is scheduled for delivery on June 16. Construction is 90%. Construction cost and estimated change orders are summarized on Page 38.

Stormwater Monitoring

No monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1.

Operation and Maintenance

None

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999.

Issues / Solutions

A visit was made by RBF on May 19 to Tree of Life Nursery to check the condition of the sod. Coverage of flats is approximately 60%.

Carlsbad Maintenance Station Bio Strip Infiltration Trench (Site ID 112207)

Construction Activities

Construction was completed on February 26, 1999. No additional work was performed since the last quarterly status report. Site was not deemed operational due to inadequate coverage of salt grass at the biofiltration strip.

Stormwater Monitoring

No stormwater monitoring has been performed at this site to date. Stormwater monitoring/sampling will begin October 1. Only empirical observations have been performed during storm events.

Operations and Maintenance

KLI and Martha Blane visited the site on May 14 to assess the condition of vegetation at the BMP site. All non-grasses will be weeded and organic debris (i.e., leaves and acorns) will be removed in mid-June.

Weekly inspections were conducted during the wet season. Per direction of the OMM Plan, KLI has switched from weekly site inspections to monthly site inspections. Site inspections will occur the first week of every month.

Vector Activities

The agreement between KLI and the County of San Diego Vector Control was finalized on April 27, 1999. On May 12, KLI met with Mike Devine and Keith MacBarron of the County of San Diego Vector Control to visit the BMP.

Issues / Solutions

Biofiltration strip was overseeded on March 23, 1999. No samples will be taken until sod attains the required coverage. Current coverage is about 70%. Irrigation will continue.

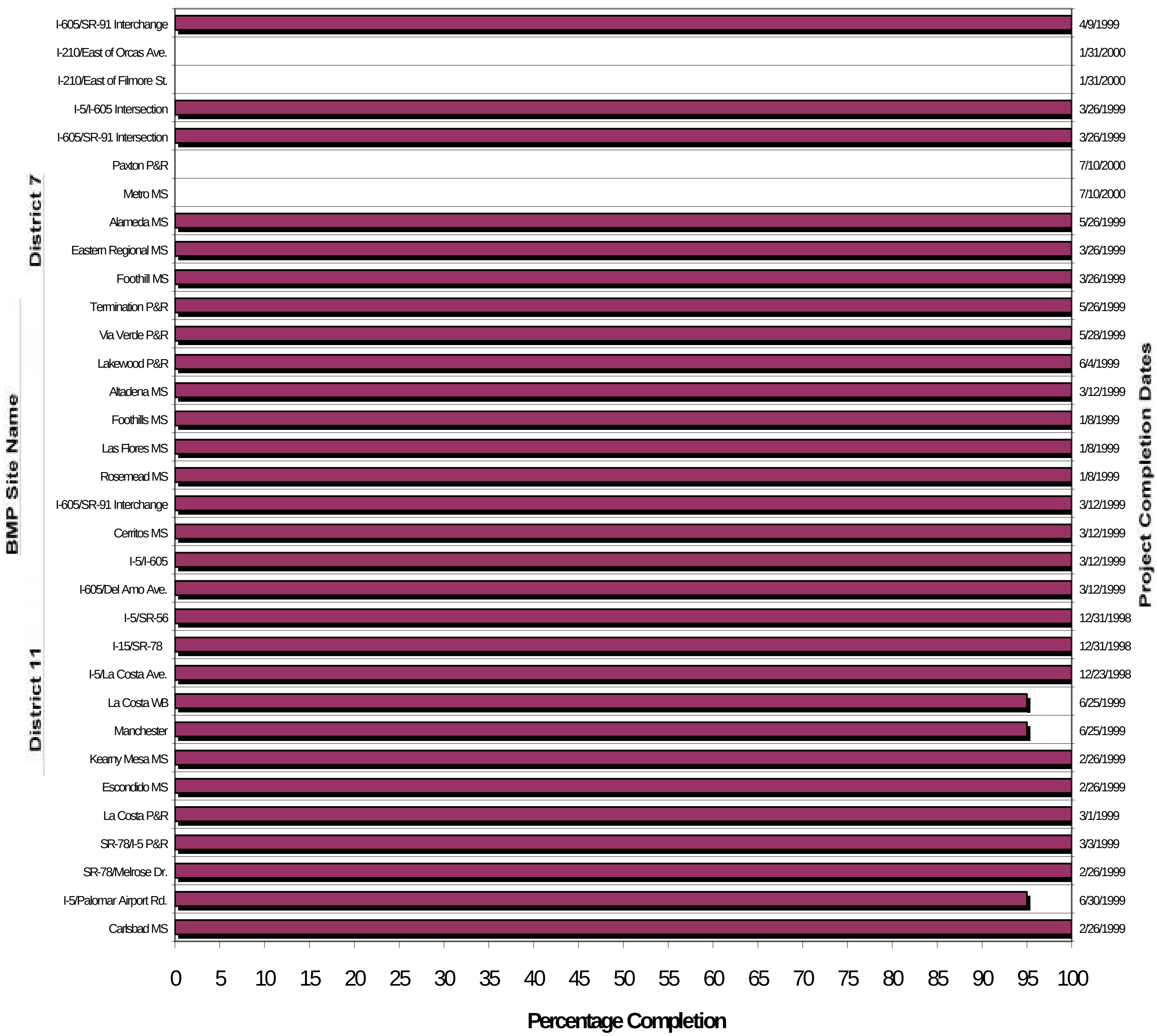
A drainage problem was noted at the site during the April 11/12 storm event. The western strip did not flow into the outlet; rather, it bypassed the outlet due to a swale curb and flowed out of the maintenance yard via the sidewalk curb. Therefore, monitoring equipment received little flow. The situation was investigated by the Engineer on 5/12. It was determined that sand bags could temporarily be placed in the gutter eliminating the escape route for the flow and redirecting the flow to the sampling flume. The temporary 'fix' was tested using the site's temporary irrigation system and proved satisfactory. A more permanent 'fix' will be made using concrete.

BMP OPERATIONS STATUS

Location	BMP Type	Monitor Consultant	Site "On-line"[2]	Begin Instrument Install	Complete Instrument Install	Operational[3] (start empirical and maintain)	Ready for Water Quality Monitoring[4]
DISTRICT 7							
I-605/SR-91	IB	MW/Law	4/9/99	2/15/99	3/26/99	4/9/99	4/9/99
I-210 East of Orcas	CDS	MW/Law	1/31/00	1/31/00	2/21/00	2/21/00	2/21/00
I-210 East of Filmore	CDS	MW/Law	1/31/00	1/31/00	2/21/00	2/21/00	2/21/00
I-5/I-605	EDB	BC	2/8/99	2/15//99	2/26/99	2/26/99	2/26/99
I-605/SR-91	EDB	BC	2/8/99	2/8/99	2/19/99	2/22/99	2/22/99
Paxton Park & Ride	MF	BC	7/10/00	7/10/00	7/30/00	7/30/00	7/30/00
Metro MS	MCTT	BC	7/10/00	7/10/00	7/30/00	7/30/00	7/30/00
Alameda MS	OWS	BC	4/19/99	4/20/99	5/7/99	5/17/99	5/17/99
Eastern MS	MF	BC	2/1/99	2/1/99	2/12/99	2/15/99	2/15/99
Foothill MS	MF	BC	2/22/99	2/22/99	3/5/99	3/8/99	3/8/99
Termination Park & Ride	MF	BC	3/26/99	4/5/99	5/7/99	5/17/99	5/17/99
Via Verde Park & Ride	MCTT	BC	4/15/99	4/19/99	5/7/99	5/17/99	5/17/99
Lakewood Park & Ride	MCTT	BC	4/30/99	4/30/99	5/7/99	5/17/99	5/17/99
Altadena	Bio Strip/IT	MW/Law	2/26/99	2/18/99	2/19/99	Fall 99	Fall 99
Foothill	DII	MW/Law	1/15/99	1/18/99	1/22/99	1/22//99	1/22/99
LasFlores	DII	MW/Law	1/15/99	1/18/99	1/21/99	1/22/99	1/22/99
Rosemead	DII	MW/Law	1/15/99	1/18/99	1/21/99	1/22/99	1/22/99
I-605/SR-91	Bio Strip/Swale	MW/Law	2/25/99	2/25/99	3/26/99	Fall 99	Fall 99
Cerritos MS	BioSwale	MW/Law	2/17/99	2/18/99	Fall 99	Fall 99	Fall 99
I-5/I-605	BioSwale	MW/Law	2/17/99	2/18/99	Fall 99	Fall 99	Fall 99
I-605/ Del Amo	BioSwale	MW/Law	2/23/99	2/22/99	Fall 99	Fall 99	Fall 99
DISTRICT 11							
I-5/SR-56	EDB	KLI	1/8/99	1/11/99	1/24/99	1/24/99	1/24/99
I-15/SR-78	EDB	KLI	1/8/99	1/11/99	1/24/99	1/24/99	1/24/99
I-5/La Costa (West)	IB	KLI	1/8/99	1/11/99	1/28/99	Suspended	Suspended
I-5/La Costa (East)	WB	KLI	6/15/99	7/24/99[5]	9/15/99[5]	9/15/99	Dec 99
I-5/Manchester (East)	EDB	KLI	6/15/99	7/24/99[5]	9/15/99[5]	9/15/99	9/15/99
Kearney Mesa MS	MF (Comp)	KLI	2/12/99	2/12/99	2/12/99	2/16/99	2/16/99
Escondido MS	MF	KLI	2/12/99	2/12/99	2/12/99	2/16/99	2/16/99
La Costa Park & Ride	MF	KLI	2/19/99	2/19/99	2/26/99	2/26/99	2/26/99
SR-78/I-5 Park & Ride	MF	KLI	2/19/99	2/19/99	3/1/99	3/1/99	3/1/99
Melrose Ave/SR-78	Bio Swale	KLI	2/19/99	2/19/99	2/26/99	10/1/99	10/1/99
I-5 Palomar Airport Road	Bio Strip	KLI	6/30/99	7/24/99	9/15/99	9/15/99	10/1/99
Carlsbad MS	Bio Strip/IT	KLI	2/19/99	2/19/99	2/26/99	10/1/99	10/1/99

1 Equipment installation schedule is dependent upon construction schedule.
2 Site on-line means BMP will receive stormwater runoff, not necessarily ready for monitoring or operations.
3 Site operational means BMP meets completion criteria and BMP is turned over to monitoring/maintenance teams to begin empirical observations and maintenance. Biofilters are dependent on plant establishment criteria of 90%. coverage
4 Ready for water quality monitoring means BMP has a full equipment installation and the equipment is ready to draw samples.
5 The inlet and outlet will be instrumented with flow meters in late July (after construction and equipment purchase) for calibration. The CR-10s and Samplers will be instrumented 1st week of September and operational 9/15/99.

Caltrans BMP Pilot Program Construction Estimate of Project Completion



DISTRICT 7 CONSTRUCTION SUMMARY

Location	First Working Day	Scheduled Completion Date	Adjusted Completion Date	Bid Amount	Contract Change Orders	Additional Shoring Cost	State Furnished Materials (Salt grass)	Estimated Final Cost Including CCO and State Furnished Materials
1 I-605/SR-91	11-6-98	1-13-99	4-9-99	$255,646	$16,900 Asphalt Concrete Adjust. $410 Traffic Control $814 Lead Sampling $1,178 Maintain Elec. Sys $862 Rem. Buried Objects $2,900 Grading Revision ($25,650) Grading Revision $2,681Expose exist. Pipe and Headwall $16,500 Pipe Extension/Headwall $1,008 Installation of Weir Plates Total $17,603		N/A	$273,249
1 I-5/I-605 (EDB – lined)	11-4-98	1-6-99	3-26-99	$119,511	$155 Inlet Drain Holes $7,000 Remove Temp. Rail/Install Guard Rail $15,830 Extend Access Road Total $22,985		N/A	$142,496
2 I-605/SR-91 (EDB – unlined)	11-4-98	1-6-99	3-26-99	$ 119,511	$155 Inlet Drain Holes $9,000 Remove Temp. Rail/Install Guard Rail, Extend AC, Install Gate $8,000 additional MBGR Total $17,155		N/A	$136,666
1 Alameda MS	12-18-98	1-27-99	5-26-99	$172,049	$3,964 Extended Overhead $686 Additional Fencing $1,467 Utility Conflicts Total $6,117		N/A	$178,166
2 Eastern MS	9-25-98	12-8-98	3-26-99	$267,570	$3,964 Extended Overhead $18,033 Utilities $2,095 Electrical $1,181 Additional Fencing $1,500 Basin Ladders Total $26,773	$47,670	N/A	$342,013
3 Foothill MS	10-1-98	1-4-99	3-26-99	$400,647	$3,964 Extended Overhead $5,508 Traffic Cover $1,500 Basin Ladders Total $10,972	$68,955	N/A	$480,574
4 Termination Park & Ride	10-1-98	12-21-98	5-26-99	$372,982	$4,545 Utilities $3,964 Extended Overhead $2,075 Additional Fencing $2,000 Basin Ladders Total $12,584	$66,132	N/A	$451,698
6 Via Verde Park & Ride	10-8-98	1-15-99	5-28-99	$309,633	$18,081 Boulder coring $407 Utilities $3,964 Extended Overhead $252 Additional Fencing	$39,663	N/A	$376,582

Location	First Working Day	Scheduled Completion Date	Adjusted Completion Date	Bid Amount	Contract Change Orders	Additional Shoring Cost	State Furnished Materials (Salt grass)	Estimated Final Cost Including CCO and State Furnished Materials
					$2,110 VOC Packing $1,472 Landscaping $1,000 Basin Ladders Total $27,286			
8 Lakewood Park & Ride	12-4-98	2-4-99	6-4-99	$388,037	$3,964 Extended Overhead $1,187 Additional Fencing $4,405 Utility Conflicts $2,110 VOC Packing $1,000 Basin Ladders Total $12,666	$57,150	N/A	$457,853
1 Package 1 Altadena	10-5-98	12-18-98	3-12-99	$197,574	$17,000 Relocate infiltration trench $581 Light Pole Foundation $1,572 Salt Grass Installation $2,781 Weir Plate & Drain Plug Total $21,934		$3,673	$223,181
6 Package 1 Foothill	10-5-98	12-18-98	1-8-99	$72,578	$174 Equipment Pad Extension ($3,038) Electrical Conduit Total ($2,864)		N/A	$69,714
7 Package 1LasFlores	10-5-98	12-18-98	1-8-99	$88,116	$174 Equipment Pad Extension ($893) Electrical Conduit Total ($719)		N/A	$87,397
8 Package1 Rosemead	10-5-98	12-18-98	1-8-99	$66,654	$6,000 G2M Cover $174 Equipment Pad Extension ($1,709) Electrical Conduit Total $4,465		N/A	$71,119
2 Package 2 I-605/SR-91	11-30-98	1-29-99	3-12-99	$166,715	($8,000) Reduced topsoil qty ($1,500) Cancel Light Pole Reloc. $1,000 Place Rock in Dissipator Total ($8,500)		$20,812	$179,027
3 Package 2 Cerritos MS	11-30-98	1-29-99	3-12-99	$57,727	$1,752 Access Gate $1,000 Place Rock in Dissipator Total $2,752		$1,225	$61,704
4 Package 2 I-5/I-605	11-30-98	1-29-99	3-12-99	$124,575	($35,000) Delete Maintenance Pullout $1,000 Place Rock in Dissipator Total ($34,000)		$7,344	$97,919
5 Package 2 I-605/ Del Amo	11-30-98	1-29-99	3-12-99	$119,895	$1,000 Place Rock in Dissipator		$4,285	$125,180
SUBTOTAL (SITES UNDER CONSTRUCTION)				**$3,299,420**	**$138,209**	**$279,570**	**$37,339**	**$3,754,538**
I-210/East of Orcas Ave							Engineer's Estimate =	$61,810
I-210/East of Filmore St.							Engineer's Estimate =	$62,775
Paxton P&R							Engineer's Estimate (see note below) =	$331,000
Metro MS							Engineer's Estimate (see note below) =	$893,000
GRAND TOTAL								**$5,103,123**

Note for Paxton and Metro- Both location s will go out to bid as one package in PS&E format.

DISTRICT 11 CONSTRUCTION SUMMARY

Location	First Working Day	Scheduled Completion Date	Adjusted Completion Date	Bid Amount	Estimated Contract Change Orders	State Furnished Material	Est. Final Cost Including CCO and State Furnished Materials
1 I-5/SR-56	9-14-98	11-18-98	12-31-98	$130,739	$25,000 Spillway excavation $7,100 Import borrow $1,300 Access road $1,500 Flume Total $34,900	N/A	$165,639
2 I-15/SR-78	9-14-98	11-18-98	12-31-98	$80,000	($240,500) Concrete lining deletion $1,014,000 Remove man made buried obj. & construction of BMP at forced account $1,500 Flume Total $775,000	N/A	$855,000
3 I-5/La Costa (West) IB	9-14-98	11-18-98	N/A	$ 208,221	$32,000 Removal of unsuitable material $400 Flagging Total $32,400	N/A	$240,621
I-5/La Costa (East) WB	Wk 4/5/99	5-29-99	6-25-/99	$602,158	$15,000 Maintain Traffic $5,000 Maintain Exist. Channel $5,000 Maintain Irrig. System $2,000 Partnering ($500) Deletion of flume purchase $2,000 Luminar Conduit Replacemt $3,000 Retaining Wall Total $31,500	$15,000 Plants $6,000 Canal Gates $5,000 RE Office $2,000 Traffic Mgmt/Public Info Total $28,000	$661,658
8 I-5/ Manchester (East)	4/8/99	5-31-99	6-25-99	$334,166	$16,000 landscape $15,000 manhole reloc & Riser Leak Repair total $31,000	$3,000 canal gate $4,000 flume total $7,000	$372,166
1 Kearney Mesa MS	11-10-98	12-17-98	2-26-99	$298,797	$6,300 Additional canisters $15,000 Bedrock/Site Revision $20,000 Additional Excavation Total $41,300	N/A	$ 340,097
2 Escondido MS	11-2-98	12-23-98	2-26-99	$490,405	($46,000) Substitution with epoxy coated $5,000 add guard posts $2,000 Elect Conduit Total ($39,000)	N/A	$451,405
3 La Costa Park & Ride	9-16-98	11-2-98	3-1-99	$ 208,955	$35,000 Unsuitable materials excavation $8,000 Storm drain extension ($15,000) Delete electrical conduit $5,500 Safety Railing/Steps Total $33,500	N/A	$242,455
4 SR-78/I-5 Park & Ride	9-23-98	11-16-98	3-3-99	$ 224,502	($14,000) Revised vault location $5,000 plant establishment $4,500 Safety railing $2,000 Manhole $1,000 Fence $8,300 Landscaping & Irrigation Sys. Total $6,800	N/A	$231,302
5 Melrose Ave/SR-78	10-7-98	11-19-98	2-26-99	87,038	$5,000 Unsuitable material $19,000 Salt grass installation $11,000 Plant establishment $4,500 Storm Drain Sediment ($2,500) Delete Seed $1,500 Flume Modifications Total $38,500	$30,889 Salt grass	$156,427
6 I-5 Palomar Airport Road	1-18-98	4-1-99	6-30-99	$114,200	$10,000 Plant Estab. & Temp. Irrigation	$17,951 Salt grass	$142,151
7 Carlsbad MS	10-12-98	11-19-99	2-26-99	$157,800	$20,000 Unsuitable subgrade $8,000 Install salt grass $5,000 Additional paving $2,000 Elect. Conduit $5,000 Infiltration Trench ($18,400) Delete bio swale bid item $5,500 Plant Establishment $1,500 Flume Modifications Total $28,600	$9,792 Salt grass	$196,192
GRAND TOTAL				**$2,936,981**	**$1,024,500**	**$93,632**	**$4,055,113**

PRELIMINARY STORMWATER QUALITY DATA FOR EVENTS UP TO APRIL 12, 1999 ARE ENCLOSED IN APPENDIX D OF THIS REPORT.

SUMMARY OF REQUIRED STORMS AND SUCCESSFULLY SAMPLED STORMS PER SITE

Location	BMP Type	Monitoring Consultant	Operational?	Total Storms Required	Successfully Sampled Storms (1)
DISTRICT 7					
I-605/SR-91	IB	MW/Law	Yes	8	
I-210 East of Orcas	CDS	MW/Law		8	
I-210 East of Filmore	CDS	MW/Law		8	
I-5/I-605	EDB	BC	Yes	10	2
I-605/SR-91	EDB	BC	Yes	10	3
Paxton Park & Ride	MF	BC		8	
Metro MS	MCTT	BC		8	
Alameda MS	OWS	BC	Yes	8	
Eastern MS	MF	BC	Yes	8	1
Foothill MS	MF	BC	Yes	8	2
Termination Park & Ride	MF	BC	Yes	8	
Via Verde Park & Ride	MCTT	BC	Yes	8	
Lakewood Park & Ride	MCTT	BC	Yes	8	
Altadena	Bio Strip	MW/Law		8	
	Infiltration Trench	MW/Law		8	
Foothill MS	DII north- Stream Guard Insert	MW/Law	Yes	8	4
	DII south- Fossil Filter Insert	MW/Law	Yes	8	4
LasFlores MS	DII north-StreamGuard Insert	MW/Law	Yes	8	5
	DII south-Fossil Filter Insert	MW/Law	Yes	8	5
Rosemead MS	DII north-Fossil Filter Insert	MW/Law	Yes	8	5
	DII south-StreamGuard Insert	MW/Law	Yes	8	5
I-605/SR-91	Bio Strip	MW/Law		8	
	Bio Swale	MW/Law		8	
Cerritos MS	BioSwale	MW/Law		8	
I-5/I-605	BioSwale	MW/Law		8	
I-605/ Del Amo	BioSwale	MW/Law		8	
DISTRICT 11					
I-5/SR-56	EDB	KLI	Yes	4	5
I-15/SR-78	EDB	KLI	Yes	10	4
I-5/La Costa (West)	IB	KLI		8	suspended
I-5/La Costa (East)	WB	KLI		4	
I-5/Manchester (East)	EDB	KLI		4	
Kearney Mesa MS	MF (Comp)	KLI	Yes	8	3
Escondido MS	MF	KLI	Yes	8	3
La Costa Park & Ride	MF	KLI	Yes	4	3
SR-78/I-5 Park & Ride	MF	KLI	Yes	8	2
Melrose Ave/SR-78	Bio Swale	KLI		8	
I-5 Palomar Airport Road	Bio Strip	KLI		8	
Carlsbad MS	Bio Strip	KLI		8	
	Infiltration Tr	KLI		8	

(1) Total number of successful storms for the DII siteswith Fossil Filter Inserts is under review (pending results of water quality data).

OMM PLAN ACTIVITIES

VOLUME I

The OMM Volume I is currently under revision to update the report to include new BMP devices in District 7 (CDS) and District 11 (Wetbasin). A formal submittal of replacement pages to Volume I will be made to all Volume I holders when all revisions (CDS information) are completed to the Volume (scheduled submittal June/July).

VOLUME II

Revisions to Volume II for CDS, Paxton, Metro (D7) and Manchester and La Costa (D11) BMP sites will be completed as a part of the 'summer revisions' so as to consolidate/facilitate review by the Plaintiffs. The summer revision schedule is as follows:

Schedule	DATE DUE
OMM recommended changes to Plaintiffs	June 29
Plaintiff comment to changes	July 7
1st draft to Plaintiffs	August 13
Plaintiff Comments due	August 27
Response to Comments	Sept 3
Final	Sept 15

MAINTENANCE INDICATOR DOCUMENT

The document was circulated for review and comments. Numerous updates have been made to the document to incorporate comments received from the Districts maintenance group. The document has been updated to incorporate comments received from the project biologist (Dudek). An updated version of the document has been included in Appendix G.

RECOMMENDED MODIFICATIONS TO THE FIELD DATA FORMS

The field monitoring team has been actively reviewing the practicality and efficiency of the field forms. Some of the changes identified thus far are as follows:

1) Deletion of Forms D (Monitoring Equipment Inspection), and Forms F (Monitoring Equipment Maintenance Activity)

2) Add a line to Form H (Empirical Observation) indicating whether the monitoring equipment is functional (yes/no/comment). This would replace the

need for Forms D and F.

3) Recordation of start and end time of the storm will be removed from the forms – impractical to record in the field. The total rainfall, etc. will be recorded later.

DEPLOYMENT CRITERIA

The monitoring team deployment criteria has been refined. The criteria was provided to the Plaintiffs and was verbally accepted during the previous Bi-weekly meeting (5/13). In summary, the criteria defines the following:

1) Deployment period October 1 to May 30 (latest);
2) Decision tree for deployment adjusted to decrease “false” starts;
3) Deployment criteria applicable to all pilots:

Forcast- unlikely:	<0.25”, <50% probability = No Go
Forcast-Marginal:	>0.25”, 50-75% probability = Caltrans Decision
Forcast-High Probable:	>0.25”, >75% probability = Go

VECTOR ACTIVITIES

Background Monitoring:

Vector monitoring was carried out as planned. Vector monitoring/sampling was conducted in both Districts 7 and 11 during each biweekly reporting period this quarter. There was no appreciable change in the numbers of individuals collected. The numbers of adults collected remain low. Vector trapping activities/monitoring will continue.

In late April/early May, public safety agencies were apprised of the continuation of vector trapping.

DISTRICT 7

San Gabriel Valley Vector Control District

Monitoring

SGVVCD reports no breeding activity at any site. However, VCD staff suspects that breeding is occurring in the Media Filter at the Foothill Maintenance Station. Conditions in the BMP appear suitable for breeding (standing water with algal growth), however sampling cannot take place due to the lack of safe ladder access to the sediment vault. The VCD will not abate until sampling shows that vector breeding is taking place. The VCD also suspects that breeding may be taking place the Multi-Chambered Treatment Train at the Via Verde Park & Ride. However, due to lack of ladder access, no proper sampling has taken place. The flume housings for the drain inlet inserts at Rosemead and Foothill were retaining some water, but no breeding has yet been observed. A formal status report on monitoring efforts thus far is currently under preparation.

Abatement

SGVCD have not performed any abatement to this date.

Greater Los Angeles County Vector Control District

Monitoring

GLACVCD began its monitoring program the week of 5/17/99. The most recent monitoring effort (6/2-3/99) showed that all BMPs contained standing water (localized areas) and several of these showed evidence of breeding. A formal status report is currently under preparation.

Abatement

GLAVCCD abated two (2) BMP sites the week of 5/17: Termination Park & Ride and Lakewood Park & Ride. Termination Park & Ride was treated with Golden Bear™ oil to eliminate mosquito pupae. This oil was used in place of other control means because of the advanced stage of development of the mosquitoes, the relatively high density of pupae encountered and the close proximity of the BMP to an elementary school. Use of this material generally only occurs when mosquito pupae are present and hatching is imminent. Golden Bear™ is a light, highly refined oil which completely volatilizes within 48 to 72 hours of application, and thus should not impede next years stormwater monitoring efforts. Lakewood Park & Ride was treated with Vectolex™ (a mosquito specific toxin of bacterial origin) to control mosquito larvae. Larvae were found in the sump well of the BMP.

GLACVCD abated five (6) BMPs the week of 5/31: I-5/I-605 Extended Detention Basin, I-605/SR-91 BioStrip/Swale, Termination Park & Ride Media Filter, Lakewood Park & Ride MCTT, I-5/I-605 Bioswale, and I-605/Del Amo Bioswale. The I-5/I-605 EDB, I-5/I-605 Bioswale, Termination MF, and Lakewood MCTT had dense populations of mosquito pupae and were treated with Golden Bear™ oil. The I-605/SR-91 BioStrip/Swale and I-605/Del Amo Bioswale contained larvae and were treated with Vectolex™. The technicians appeared to have been taken by surprise at the fast rate of development of the mosquitoes in the BMPs. It also appears that the technicians are still getting acquainted with the sites. The use of Golden Bear™ should become less frequent as monitoring schedules become more “routine”.

Los Angeles County West Vector Control District

Monitoring

A service agreement for monitoring and abatement services has not been signed. LACWVCD. This district contains only one BMP (Las Flores), a drain inlet insert. These devices have not been problematic in other districts and it appears unlikely that they are breeding.

DISTRICT 11

County of San Diego Vector Surveillance and Control

Monitoring

CSDVSC began monitoring the week of 5/3/99. All BMPs were visited on 5/3, 5/19, 5/24 and 6/1/1999. They have been able to monitor/sample every BMP thus far. CSDSVC has observed mosquitoes at the I-5/La Costa Infiltration Basin and the SR-78/I-5 Park & Ride MF, but only limited vector breeding (0.1 to 0.2 larvae/dip) was observed and no action was recommended. Several sites (I-5/La Costa IB, La Costa Park & Ride MF, SR-78/I-5 Park & Ride MF) showed signs of midge breeding activity though no treatment was recommended. There was also evidence of vertebrate (ground squirrel) activity at the Melrose/SR-78 Bio Swale, but no action was recommended. A formal status report on monitoring efforts thus far is currently under preparation.

Abatement

Thus far, CSDVSC has abated only one site, the I-5/La Costa Infiltration Basin. The BMP was treated with Altosid (a mosquito specific synthetic juvenile hormone) and Mosquito fish (Gambusia affinis) in late March of this year. Limited vector breeding is still visible, though the mosquito fish appear to be keeping mosquito levels down to a reasonable level. CSDVSC has not recommended treatment of any other BMPs.

DEPARTMENT OF HEALTH SERVICES

The DHS Task Orders have been finalized and should be signed this week. Among other tasks, two DHS biologists will coordinate the monitoring and abatement efforts of the VCDs and perform a research study to determine the vector production potential of the BMPs. Work on these projects should begin later this month.

The sites monitored by the each VCD and status of agreement is summarized in the following table:

Sites Monitored by Vector Control District

Location	BMP Type	Monitor Consultant	Vector Control District	Agreement Status	Activities
DISTRICT 7					
I-605/SR-91	IB	MW/Law	GLACVCD	Exec. Wk 5/31	Standing water noted in the overflow control structure in early June.
I-210 East of Orcas	CDS	MW/Law	GLACVCD	Exec. Wk 5/31	
I-210 East of Filmore	CDS	MW/Law	GLACVCD	Exec. Wk 5/31	
I-5/I-605	EDB	BC	GLACVCD	Exec 5/13/99	Vector activity noted on 2/22 and 2/23; VCD notified. Egg rafts collected on 4/ 20. Mosquito pupae treated the week of 5/31.
I-605/SR-91	EDB	BC	GLACVCD	Exec 5/13/99	Standing water noted at localized area in early June; currently no standing water.
Paxton Park & Ride	MF	BC	GLACVCD	Exec 5/13/99	
Metro MS	MCTT	BC	GLACVCD	Exec 5/13/99	
Alameda MS	OWS	BC	GLACVCD	Exec 5/13/99	Standing water noted in early June near measuring device; no breeding observed.
Eastern MS	MF	BC	GLACVCD	Exec 5/13/99	Standing water noted in in the pump wet well area early June; currently, no standing water. Screens will be installed by mid-June.
Foothill MS	MF	BC	SGVVCD	Exec 5/7/99	Visit by VCD in May; standing water and algal growth noted in sediment vault. Installation of ladder recommended. Screens have been installed.
Termination Park & Ride	MF	BC	GLACVCD	Exec 5/13/99	Visit by VCD week of 5/17; water in sediment chamber contained pupae; water was treated. Ladder may be installed. Screens will be installed by mid-June.
Via Verde Park & Ride	MCTT	BC	SGVVCD	Exec 5/7/99	Visit by VCD in May; installation of ladder recommended. Screens will be installed by mid-June.
Lakewood Park & Ride	MCTT	BC	GLACVCD	Exec 5/13/99	Visit by VCD week of 5/17; samples of standing water contained mosquito larvae; water was treated. Mosquito pupae treated the week of 5/31. Screens will be installed by mid-June. Ladder may be installed.
Altadena	Bio Strip/IT	MW/Law	GLACVCD	Exec. Wk 5/31	Standing water noted in the spreader ditch upstream of the bio-strip in early June.
Foothill	DII	MW/Law	SGVVCD	Exec. Wk 5/31	Visits made by VCD; flume housing observed to retain water.
LasFlores	DII	MW/Law	LA Co West	Under Negotiation	
Rosemead	DII	MW/Law	SGVVCD	Exec. Wk 5/31	Visits made by VCD; flume housing observed to retain water.
I-605/SR-91	Bio Strip/Swale	MW/Law	GLACVCD	Exec. Wk 5/31	Vector activity noted on 3/11; VCD notified. Mosquito larvae treated the week of 5/31.
Cerritos MS	BioSwale	MW/Law	GLACVCD	Exec. Wk 5/31	Vector activity noted on 2/23 and 3/11; VCD notified. Standing water noted in the energy dissipater in early June.
I-5/I-605	BioSwale	MW/Law	GLACVCD	Exec. Wk 5/31	Egg rafts collected on 4/20. Pupae treated the week of 5/31.
I-605/ Del Amo	BioSwale	MW/Law	GLACVCD	Exec. Wk 5/31	Mosquito larvae treated the week of 5/31. Standing water noted in the energy dissipater in early June.
DISTRICT 11					
I-5/SR-56	EDB	KLI	SD Co VC	Exec 4/27/99	Visit by KLI and VC on 5/12; mouse droppings found.
I-15/SR-78	EDB	KLI	SD Co VC	Exec 4/27/99	Visit by KLI and VC on 5/12.
I-5/La Costa (West)	IB	KLI	SD Co VC	Exec 4/27/99	Monitored by RBF for vector presence in March; treated with altosid briquettes and mosquito fish in late March. During the month of May, VC monitoring visit conducted; vector activity noted at the site; site treated with altosid briquettes.
I-5/La Costa (East)	WB	KLI	SD Co VC	Exec 4/27/99	
I-5/Manchester (East)	EDB	KLI	SD Co VC	Exec 4/27/99	
Kearney Mesa MS	MF (Comp)	KLI	SD Co VC	Exec 4/27/99	SD Co VC monitoring visit conducted in May.
Escondido MS	MF	KLI	SD Co VC	Exec 4/27/99	SD Co VC monitoring visit conducted in May; VC advised to sample site.
La Costa Park & Ride	MF	KLI	SD Co VC	Exec 4/27/99	Vector activity noted in standing water on 4/27. Visit by VC in May; one midge captured.
SR-78/I-5 Park & Ride	MF	KLI	SD Co VC	Exec 4/27/99	SD Co VC monitoring visit conducted in May; signs of midge breeding activity noted.
Melrose Ave/SR-78	Bio Swale	KLI	SD Co VC	Exec 4/27/99	SD Co VC monitoring visit conducted in May.
I-5 Palomar Airport Road	Bio Strip	KLI	SD Co VC	Exec 4/27/99	
Carlsbad MS	Bio Strip/IT	KLI	SD Co VC	Exec 4/27/99	SD Co VC monitoring visit conducted in May.

ENVIRONMENTAL ISSUES

A bioligical monitoring assessment/survey of the BMP sites has been conducted by the project biologist (Dudek & Associates, a San Diego based biologist).

The Maintenance Indicator document has been reviewed by Dudek. Comments have been incorporated into the Maintenance Indicators. A letter report prepared by Dudek is enclosed in Appendix I.

On May 21, a Dudek biologist visited the Killdeer eggs nest found at the La Costa P&R Media Filter site. The biologist has confirmed that the nest is no longer occupied. The crew has been cleared to use all gates of the BMP site.

WEATHER

Precipitation data for Los Angeles and San Diego for the months of March, April, May and June were obtained from NOAA (see Tables, below).

March 1999

Los Angeles – Civic Center				San Diego			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	1	0.0	16	0.02
2	0.0	17	0.0	2	0.0	17	0.0
3	0.0	18	0.0	3	0.0	18	0.0
4	0.0	19	0.0	4	0.07	19	0.0
5	0.0	20	0.22	5	0.0	20	Trace
6	0.0	21	0.0	6	0.0	21	0.0
7	0.0	22	0.0	7	0.11	22	Trace
8	0.0	23	0.0	8	0.0	23	0.0
9	0.10	24	0.0	9	0.0	24	0.0
10	0.0	25	0.0	10	0.0	25	0.36
11	Trace	26	0.08	11	NA	26	0.20
12	0.0	27	0.0	12	0.0	27	NA
13	0.0	28	0.0	13	0.0	28	0.0
14	0.0	29	0.0	14	0.0	29	0.0
15	Trace	30	0.0	15	0.16	30	0.0
		31	0.0			31	Trace

April 1999

Los Angeles – Downtown				San Diego			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	1	0.31	16	0.0
2	0.03	17	0.0	2	0.28	17	0.0
3	0.0	18	0.0	3	0.0	18	0.0
4	0.0	19	0.0	4	0.11	19	0.0
5	0.0	20	0.0	5	0.0	20	0.0
6	0.73	21	0.0	6	Trace	21	0.0
7	0.39	22	0.0	7	0.33	22	NA
8	0.0	23	0.0	8	0.0	23	Trace
9	0.08	24	0.01	9	0.01	24	0.0
10	0.0	25	0.0	10	0.0	25	0.0
11	0.28	26	0.0	11	Trace	26	0.0
12	1.06	27	0.0	12	0.58	27	0.0
13	0.0	28	0.0	13	0.0	28	Trace
14	0.0	29	0.0	14	0.0	29	Trace
15	0.0	30	Trace	15	0.0	30	0.0

May 1999

Los Angeles – Downtown				San Diego			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	1	0.0	16	0.0
2	0.0	17	0.0	2	0.0	17	0.0
3	0.0	18	0.0	3	0.0	18	0.0
4	0.0	19	0.0	4	0.0	19	0.0
5	0.0	20	0.0	5	0.0	20	0.0
6	0.0	21	0.0	6	0.0	21	Trace
7	0.0	22	0.0	7	0.0	22	0.0
8	0.0	23	0.02	8	0.0	23	0.06
9	0.0	24	0.0	9	0.0	24	0.0
10	0.0	25	0.0	10	0.0	25	0.0
11	0.0	26	NA	11	0.0	26	0.0
12	0.0	27	NA	12	0.0	27	0.0
13	0.0	28	0.0	13	Trace	28	0.0
14	0.0	29	NA	14	0.0	29	0.0
15	0.0	30	0.0	15	0.0	30	0.0
		31	0.0			31	0.0

June 1999

Los Angeles – Downtown				San Diego			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16		1	Trace	16	
2	0.52	17		2	0.02	17	
3	0.21	18		3	Trace	18	
4	0.0	19		4	0.02	19	
5	0.0	20		5	0.0	20	
6	0.0	21		6	0.0	21	
7	0.0	22		7	0.0	22	
8	NA	23		8	0.0	23	
9	0.0	24		9	0.0	24	
10	0.0	25		10	0.0	25	
11	0.0	26		11	0.0	26	
12	0.0	27		12	0.0	27	
13	0.0	28		13	0.0	28	
14	0.0	29		14	0.0	29	
15		30		15		30	

The data presented here is as a reference only. The actual rainfall at individual BMP sites will vary from the values given in the table. The data presented above for Los Angeles is as of 4:00 p.m. for the preceding 24 hours on the date indicated. For San Diego, is as of 5:00 p.m. for the preceding 24 hours.

APPENDIX A:

MEETING MINUTES STATUS NO. 4

Robert Bein, William Frost & Associates
PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS

JN: 10-034123/034218

STORMWATER PLANNING SERVICES
CONTRACT NO. 43A0004A
Meeting Minutes

ISSUE VERSION: FINAL

MEETING NO.: 4
DATE: March 11, 1999
TIME: 9:00 am
LOCATION: RBF

SUBJECT: Status Meeting No. 4

Prepared by: S. Taylor

Approved by: (Signature)

Date Prepared: March 18, 1999

Attendee Names / Company

Jerome Ruddins/RBF
Ann Walker/RBF
Bill Whittenberg/RBF
Deborah Neiter/RBF
Charles Belenky/CT
Peter Van Riper/CT
Dean Messer/LWA
Ed Othmer/LC
Gary Fiedman/MW-C
Brian Currier/CT/UCD
Steve Borroum/CT
Jeremy Johnstone/EPA
Rick Graff/SD BayKeeper
Everett Delano/NRDC (phone)

Attendee Names / Company

Scott Taylor/RBF
Anna Lantin/RBF
Cid Tesoro/CT
Marcelo Peinado/CT
Mike Barrett/RBF/UT
Mark Moser/MW
Rich Horner/NRDC
Sayra Ramos/CT
Bob Finn/BCC
Doug Robison/BCC
Bob Wu/CT
Gary Conklin/RBF
Jeff Joseph/CT (phone)

Copies To:

File

The following items presented summarize the substantive items discussed or issues resolved at the above meeting to the best of the writer's memory.

ITEM	DESCRIPTION	STATUS	OPENED	DUE	ACTION FOR:
1.	Opening remarks: Caltrans indicated a budget deficit for the Pilot program, but that the program was a priority with the Department. Plaintiffs indicated some of the information (letters) for the Status Meeting meeting arrived late, and they were not fully prepared to discuss all items contained therein. The Plaintiffs also indicated that they feel there have been some elements of the program where excess expenditures have occurred.	FYI			
2.	Item 3a: Background information is under development for the La Costa Infiltration Basin, it was noted that the report will be ready for Plaintiff review by March 31, 1999. Plaintiffs indicated that the site should not be unilaterally decomissioned by Caltrans	New	3/11	3/31	RBF
3.	Item 3b: The problem with the infiltration trench at Carlsbad MS was reviewed. It was noted that the problem is a lack of homogeneous fracturing of the terrace deposit at the site.	New	3/11		
4.	Item 3c: It was noted that the remaining issues with the I-15/SR78 EDB (slope rill, ponding in invert, area drainage) had been resolved. Photos of the site were shown.	Closed			
5.	Item 3d: The problems to date observed relative to drain inlet inserts were reviewed, principally flow by-pass and clogging. Caltrans offered that a different type of insert could be substituted for the Foss Streamguard unit at the Plaintiffs option. Plaintiff indicated that Mike Stenstrom of UCLA should be consulted for a possible substitute candidate. Caltrans directed MW-C to consult with UCLA and Gary Minton on this issue.	New	3/11	5/11	MW-C
6.	Item 3e: The problem with the poor quality of the sod was discussed. It was indicated that the sod will be overseeded and watered to ensure good growth by June. CT indicated full payment would not be made to the nursery. The issue of seed vs. sod was also discussed. Caltrans indicated that biofilters must be ready to accept flow virtually from the day they are installed. This would not be practical with seed. It was also noted that establishment from seed would require intensive watering, and irrigation is not available at most highway sites.	New	3/11	6/30	RBF
7.	Item 3f: The infiltration basin at I-605/SR 91 was constructed at the wrong grade. MW-C noted that the contractor will correct as his expense. Plaintiff noted that care must be taken in the regrading processes to ensure the basin invert is not compacted.	New	3/11	4/15	MW-C
8.	Item 3g: Problems with the flow spreading device at Altadena MS were discussed. MW-C noted that a new weir plate was installed to ensure even sheet flow. MW-C also indicated that some type of splash device would be installed to ensure that a concentrated flow 'jet' would not proceed across the strip during high flow events.	New	3/11	4/15	MW-C
9.	Item 3h: I-605/I-5 EDB outlet structure and potential erosion problems were discussed. Plaintiff is concerned that outlet structure may not perform well. BCC noted that this is a common type design, well supported in literature, and would be a good opportunity to compare performance with other outlet design types in San Diego. Plaintiff concurred and indicated this should be recorded as part of the project experience. The other issue at this site is potential erosion downstream of basin. CT directed	New	3/11	4/15	BCC

ITEM	DESCRIPTION	STATUS	OPENED	DUE	ACTION FOR:
	BCC to study this issue and propose a solution. CT also directed BCC to install more riprap around the splitter structure.				
10.	Item 3I: Erosion issues: Plaintiff was concerned about the lack of erosion protection at Cerritos MS swale, I-605 swale. RBF indicated that the sites were currently being hydroseeded with the project erosion control mix.	New	3/11	3/31	MW-C
11.	Item 3j: Concrete Spillways: RBF explained that the purposed of the spillways on the project basins was for emergency overflow only, and that the spillways would likely never experience flow since the riser outlets were designed in each case to accept the maximum discharge to the basins. Plaintiffs concurred with explanation.	FYI			
12.	Caltrans indicated that it would not sample at the BMP sites but would instead use the remainder of the season to debug the sampling equipment. Empirical observations at all sites would continue this season for those sites that are online. Plaintiffs indicated that they would prefer that the monitoring and sampling be done for this season at those sites that are ready.				
13.	Plaintiffs indicated that the Caltrans design storm may be too large, resulting in higher costs for construction under the pilot program. Caltrans indicated that the current department design storm is consistent with other locations in the southwest, and may be too small from the regulators perspective. However, Caltrans is also currently reviewing SCWRP data and may fine tune the current design storm in the future.	FYI			
14.	Item 4: The review of the Caltrans response to the Plaintiff Memo dated February 11, 1999 was deferred. A response letter was provided to the Plaintiffs later in the meeting for review and comment.	FYI			
15.	Item 5: The La Costa Wetpond project is currently under bid through the PSE process. Bid opening will be on the 24th of March, start of construction on the 29th. There is a 60 calendar day work period, 45 working days. The engineer's estimate is $720,000. Plant stock for the project has been secured from four nurseries, the contract has 120 days for plant establishment. The Manchester EDB is being processed as a change-order to the existing PSE contract with Excel Constructors. Work will start the week of March 22. Completion is scheduled for the end of May. The Change Order for this site is $350,000.	FYI			
16.	Item 6a: Caltrans is in the process of developing a statement, as requested by the Plaintiffs, relative to the use of StormTreat for the current pilot project.	New	3/11	3/19	Caltrans
17.	Item 6b: The CDS units/sites are currently under design. Caltrans to set a design review meeting with the Plaintiffs for the week of either March 16 or March 22nd. Caltrans is involving the manufacturer, CDS with the design of the units.	New	3/11	3/26	Caltrans
18.	Item 6c: The Paxton Park and Ride will be constructed as a sand media filter. Plans are currently being finalized, and no significant changes have been made as compared to the design originally shared with the Plaintiffs.	FYI			

ITEM	DESCRIPTION	STATUS	OPENED	DUE	ACTION FOR:
19.	Item 6d: The MCTT unit at the Metro Maintenance Station is currently under redesign to avoid the influence area of the bridge column footing. A revised design will be forwarded to the Plaintiffs per the schedule in the bi-weekly report.	New	3/11	10/1/99	BCC
20.	Item 7: The County of San Diego and the three Vector Districts have agreed to the conditions, and are placing the consultant service agreements with their Boards as consent items. Caltrans indicated that they will request that the Vector Districts document that there will be a stepwise treatment approach, progressing from non-insecticide related to treatment with chemicals as required to abate the problem. The interagency agreement has been signed with the DHS. There have been two sites reported with vector problems to date, in District 7 (Cerritos MS and I-5/I-605 EDB). VCD's have been notified.	New	3/11	5/30	LWA
21.	Item 8: Plaintiffs indicated they had forwarded comments on the Maintenance Indicators document, and that overall it appeared to be comprehensive. RBF distributed manufacturers data for proprietary BMPs. Caltrans indicated that a bioassessment team had been initiated to pursue a safe harbors agreement with the FWS. The Plaintiffs will be kept abreast of developments with the FWS.	FYI			
22.	The meeting concluded with the Plaintiffs stating that they continue to feel that some of the program costs are excessive, and that too much detail and structure is being put in the processes, also tending to increase costs. Caltrans responded that the objective is to run the program professionally, and also fit the projects into the normal Caltrans delivery process. Caltrans will continue to look for areas where improvements can be made.	FYI			

APPENDIX B:

DISTRICT 7 FIRST YEAR 1998-1999 MONITORING REPORT

CALTRANS
BMP RETROFIT PILOT PROGRAM

DISTRICT 7, LOS ANGELES

BMP OPERATION, MAINTENANCE, AND MONITORING

STATUS REPORT

BROWN AND CALDWELL

June 1999

RETROFIT PILOT PROGRAM
CALTRANS DISTRICT 7

BEST MANAGEMENT PRACTICES OPERATION, MAINTENANCE, AND MONITORING STATUS REPORT

1.0 BMP WATER QUALITY MONITORING

This summary report encapsulates the 1998/1999 water quality monitoring at a portion of District 7 sites involved in the Caltrans Best Management Practices (BMP) Retrofit Pilot Program. Stormwater monitoring occurred as BMP construction was completed, which initiated on March 20, 1999.

This report addresses District 7 BMP locations that were monitored under the responsibility of Brown and Caldwell. Montgomery Watson and Law/Crandall also share the BMP Pilot Program monitoring responsibility in District 7, and it is suggested that the corresponding synopsis authored by these consultants be reviewed to gain a full perspective of the District 7 BMP effort.

The data presented in this document is preliminary and has not been subject to full-scale validation and quality-control review. It is presented as summary information only as an indicator to stormwater monitoring characteristics, which is not intended as an analytical assessment. Final review and decisions regarding the validity of storm results are expected to be detailed in further reports that will be prepared during summer 1999.

It is important to note that the results presented here are based on early field exposures of newly constructed BMP treatment units, and, as such, should be judged as undergoing early “break in” conditions. During these first exposures, structural, instrumental, mechanical, and aesthetic adjustments were made to improve operation. In particular, flow measurement instruments at several locations were not accurate when exposed to real field conditions. Based on the knowledge gained in these early exposures, BMP performance, monitoring instrument accuracy, and hydraulic functions (pumping schemes, etc.) will be improved for the 1999/2000 monitoring season.

For ease of presentation, refer to the end of each respective section for all referenced figures.

1.1 Hydrology

The sections that follow describe BMP and site hydrological characteristics as observed during storm monitoring events and maintenance inspections during 1998/1999.

1.1.1 Precipitation During the 1998/1999 Water Year (Indicator Sites and BMPS)

The indicator site for District 7 correlation was the Civic Center in downtown Los Angeles. Although weather conditions and patterns were significantly different between this "reference" location the data gathered did offer some correlating information. This indicator site does reflect similar rainfall occurrences during wet season monitoring at Brown and Caldwell District 7 BMP sites. Refer to the summary tabulation below (Tables 1.1.1.1 through 1.1.1.5) for comparison of these sites relative to the indicator location. Measured rainfall values have been bolded for ease of reference.

Table 1.1.1.1
Measured Rainfall, Los Angeles Civic Center, March 1 through April 16, 1999.

March 1999 Los Angeles Civic Center				April 1—16, 1999 Los Angeles Civic Center			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	1	0.0	16	0.0
2	0.0	17	0.0	**2**	**0.03**	17	
3	0.0	18	0.0	3	0.0	18	
4	0.0	19	0.0	4	0.0	19	
5	0.0	**20**	**0.22**	5	0.0	20	
6	0.0	21	0.0	**6**	**0.73**	21	
7	0.0	22	0.0	**7**	**0.39**	22	
8	0.0	23	0.0	8	0.0	23	
9	**0.10**	24	0.0	**9**	**0.08**	24	
10	0.0	25	0.0	10	0.0	25	
11	**T**	**26**	**0.08**	**11**	**0.28**	26	
12	0.0	27	0.0	**12**	**1.06**	27	
13	0.0	28	0.0	13	0.0	28	
14	0.0	29	0.0	14	0.0	29	
15	**T**	30	0.0	15	0.0	30	
		31	0.0				

The data presented here is as a reference only. The actual rainfall at individual BMP sites will vary from the values given in the table. The data presented above for Los Angeles is as of 4:00 p.m. is for the preceding 24 hours on the date indicated.

Table 1.1.1.2
Measured Rainfall, 5/605 Extended Detention Basin, March 1 through April 16, 1999.

March 1999 5/605 Extended Detention Basin				April 1—16, 1999 5/605 Extended Detention Basin			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	**1**	**0.17**	16	0.0
2	0.0	17	0.0	2	0.0	17	
3	0.0	18	0.0	3	0.0	18	
4	**0.03**	19	0.0	4	0.0	19	
5	0.0	**20**	**0.17**	5	0.0	20	
6	0.0	21	0.0	**6**	**0.57**	21	
7	**0.01**	22	0.0	**7**	**0.2**	22	
8	0.0	23	0.0	**8**	**0.04**	23	
9	0.0	24	0.0	**9**	**0.01**	24	
10	0.0	**25**	**0.04**	10	0.0	25	
11	0.0	26	0.08	**11**	**1.03**	26	
12	0.0	27	0.0	**12**	**0.02**	27	
13	0.0	28	0.0	13	0.0	28	
14	0.0	29	0.0	14	0.0	29	
15	0.0	30	0.0	15	0.0	30	
		31	0.0				

Table 1.1.1.3
Measured Rainfall, 605/91 Extended Detention Basin, March 1 through April 16, 1999.

March 1999 605/91 Extended Detention Basin				April 1—16, 1999 605/91 Extended Detention Basin			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	**1**	**0.17**	16	0.0
2	0.0	17	0.0	**2**	**0.01**	17	
3	**0.01**	18	0.0	**3**	**0.03**	18	
4	**0.03**	19	0.0	4	0.0	19	
5	0.0	**20**	**0.14**	5	0.0	20	
6	0.0	21	0.0	**6**	**0.44**	21	
7	0.0	22	0.0	**7**	**0.31**	22	
8	0.0	23	0.0	8	0.0	23	
9	**0.04**	24	0.0	**9**	**0.04**	24	
10	0.0	**25**	**0.58**	10	0.0	25	
11	**0.03**	26	0.0	**11**	**1.36**	26	
12	0.0	27	0.0	**12**	**0.29**	27	
13	0.0	28	0.0	13	0.0	28	
14	0.0	29	0.0	14	0.0	29	
15	**0.64**	30	0.0	15	0.0	30	
		31	0.0				

Table 1.1.1.4
Measured Rainfall, Eastern Regional MS Sand Filter, March 1 through April 16, 1999.

March 1999 **Eastern Regional MS Sand Filter**				April 1—16, 1999 **Eastern Regional MS Sand Filter**			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	**1**	**0.14**	16	ND
2	0.0	17	0.0	2	0.0	17	
3	**0.05**	18	0.0	3	0.0	18	
4	0.0	19	0.0	4	0.0	19	
5	0.0	20	0.22	5	0.0	20	
6	0.0	21	0.0	**6**	**0.58**	21	
7	0.0	22	0.0	**7**	**0.28**	22	
8	0.0	23	0.0	**8**	**0.09**	23	
9	**0.04**	24	0.0	9	ND	24	
10	0.0	**25**	**0.14**	10	ND	25	
11	0.0	26	0.08	11	ND	26	
12	0.0	27	0.0	12	ND	27	
13	0.0	28	0.0	13	ND	28	
14	0.0	29	0.0	14	ND	29	
15	**0.5**	30	0.0	15	ND	30	
		31	0.0				

ND = No data.

Table 1.1.1.5
Measured Rainfall, Foothill MS Sand Filter, March 1 through April 16, 1999.

March 1999 **Foothill MS Sand Filter**				April 1—16, 1999 **Foothill MS Sand Filter**			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	**1**	**0.07**	16	0.0
2	0.0	17	0.0	2	0.0	17	
3	0.0	18	0.0	3	0.0	18	
4	0.0	19	0.0	4	0.0	19	
5	0.0	20	ND	5	0.0	20	
6	0.0	21	0.0	**6**	**1.12**	21	
7	0.0	22	0.0	**7**	**0.34**	22	
8	0.0	23	0.0	**8**	**0.12**	23	
9	0.0	24	0.0	9	0.0	24	
10	0.0	**25**	**0.01**	10	0.0	25	
11	0.0	**26**	**0.25**	**11**	**0.68**	26	
12	0.0	27	0.0	**12**	**0.18**	27	
13	0.0	28	0.0	13	0.0	28	
14	0.0	29	0.0	14	0.0	29	
15	0.0	30	0.0	15	0.0	30	
		31	0.0				

ND = No data.

1.1.2 Precipitation during Monitored Events

Precipitation was measured at all sites with a tipping rain-gauge bucket, capable of measuring every 0.01 inches of rainfall. Precipitation during the monitored events varied from storm event and BMP site. For all events, rainfall ranged from a low of 0.57 inches to 1.62 inches. Brown and Caldwell mobilized for four storm events during the 1998/1999 season, however the first storm event (of March 20, 1999) did not produce enough rainfall and, therefore, is not represented in the report. Three storm events were successfully captured to varying degrees. The types of BMPs monitored during the 1998/1999-storm season were two extended detention basins (EDB) and two sand filters (SF). The storms and BMP sites that were monitored include:

- **Event 1** March 20, 1999 – Cancelled due to insufficient rainfall (no monitoring),
- **Event 2**: March 25, 1999 - EDB Site 74102 (I-605/SR-95),
- **Event 3**: April 6, 1999 - EDB Site 74101 (I-5/I-605), EDB Site 74102 (I-605/SR-95), SF Site 74202 (Eastern Regional Maintenance Station), and SF Site 74203 (Foothill Maintenance Station), and
- **Event 4**: April 11, 1999 - EDB Site 74101 (I-5/I-605), EDB Site 74102 (I-605/SR-95), and SF Site 74203 (Foothill Maintenance Station).

Summary statistics for storm events are summarized in Table 1.1.2.1 (rainfall) and Table 1.1.2.2 (flow).

1.1.2.1 Rainfall Data – Event 1 (March 20, 1999)

This storm monitoring event was cancelled due to an insufficient amount of rainfall. Therefore, no data was collected for this event.

1.1.2.2 Rainfall Data - Event 2 (March 25, 1999)

During the first monitored storm event of March 25, 1999, the I-605/SR-91 EDB received 0.57 inches of rainfall from 08:00 PST to 17:30 PST (9.5 hours). The rainfall had a maximum intensity of 0.12 inches/hour. No other sites were successfully monitored. The rainfall began at approximately 08:00 PST and ended around 17:30 PST. The last rainfall, previous to this storm, was 4.9 days with a rainfall amount of 0.13 inches (the aborted Event 1).

Table 1.1.2.1
Summary of Storm Rainfall Statistics, District 7 BMPs, Brown and Caldwell

Site/Event	Event Rainfall Data: Start (date / time)	Stop (date / time)	Duration (hh:mm)	Total (inches)	Maximum Intensity (inches/hour)	Antecedent (days)	Antecedent (inches)
Event 2							
I-605/SR-91	3/25/99 8:00	3/25/99 17:30	9:30:00	0.57	0.12	4.9	0.13
Event 3							
I-5/I-605-Inf	4/6/99 7:00	4/7/99 10:45	27:45:00	0.77	0.32	4.5	0.17
I-605/SR-91-Inf	4/6/99 7:00	4/7/99 14:00	31:00:00	0.71	0.16	11.6	0.17
Eastern-Inf	4/6/99 7:30	4/7/99 11:06	27:36:00	0.86	0.16	11.6	0.14
Foothill-Inf	4/6/99 7:00	4/7/99 11:00	28:00:00	1.45	0.60	11.0	0.07
Event 4							
I-5/I-605-Inf	4/11/99 11:05	4/12/99 0:07	13:02:00	1.48	0.32	4.0	0.77
I-605/SR-91-Inf	4/11/99 13:00	4/12/99 1:28	12:28:00	1.62	0.36	4.0	0.71
Foothill-Inf	4/11/99 13:00	4/12/99 2:51	13:51:00	0.85	0.24	4.1	0.25

Table 1.1.2.2
Summary of Storm Flow Statistics, District 7 BMPs, Brown and Caldwell

Site/Event	Event Flow Data: Start (date / time)	Stop (date / time)	Duration (hh:mm)	Retention (hh:mm)	Total (cf)	Peak (cfs)	Estimated Capture (percent)	Peak Capture (Y/N)
Event 2								
I-605/SR-91-Inf	3/25/99 11:31	3/25/99 16:57	5:26:00	6:06:00	1,402	0.36	100	Y
I-605/SR-91-Eff	3/25/99 12:04	3/25/99 17:37	5:33:00		680	0.06	100	Y
Event 3								
I-5/I-605-Inf	4/6/99 8:48	4/7/99 13:49	29:01:00	55:04:00	6,511	0.41	100	Y
I-5/I-605-Eff	4/6/99 12:07	4/8/99 15:52	51:45:00		1,109	0.01	99	Y
I-605/SR-91-Inf	4/6/99 9:08	4/7/99 11:01	25:53:00	28:04:00	2,216	0.64	100	Y
I-605/SR-91-Eff	4/6/99 10:18	4/7/99 13:12	26:54:00		510	0.55	100	Y
Eastern-Inf	4/6/99 8:19	4/7/99 12:22	28:03:00	45:26:00	4,374	0.15	95	Y
Eastern-Eff	4/6/99 10:34	4/8/99 5:45	43:11:00		8,196	0.23	79	Y
Foothill-Inf	4/6/99 9:42	4/7/99 11:13	25:31:00	44:20:00	6,883	0.59	99	Y
Foothill-Eff	4/6/99 10:27	4/8/99 6:02	43:35:00		22,805	0.23	95	Y
Event 4								
I-5/I-605-Inf	4/11/99 14:46	4/11/99 21:58	7:12:00	121:09:00	12,084	0.98	87	Y
I-5/I-605-Eff	4/11/99 17:01	4/16/99 15:55	118:54:00		13,796	0.13	75	Y
I-605/SR-91-Inf	4/11/99 14:34	4/11/99 21:48	7:14:00	15:46:00	7,160	1.40	70	Y
I-605/SR-91-Eff	4/11/99 15:28	4/12/99 6:20	14:52:00		1,964	1.02	97	Y
Foothill-Inf	4/11/99 13:27	4/12/99 2:51	13:24:00	33:35:00	4,381	0.41	100	Y
Foothill-Eff	4/11/99 15:17	4/12/99 23:02	31:45:00		17,995	0.21	99	Y

1.1.2.3 Rainfall Data - Event 3 (April 6, 1999)

For the second monitored storm event of April 6, 1999, samples were collected at all four of the online sites. Rainfall amounts ranged from 0.71 inches, at the I-605/SR-91 EDB, to 1.45 inches at the Foothill Maintenance Station SF. Rain intensity ranged from 0.16 inches/hour at the I-605/SR-91 EDB and the Eastern Regional Maintenance Station SF to 0.60 inches/hour at the Foothill Maintenance Station SF. Rainfall duration ranged from approximately 27.5 hours to 31 hours at Eastern Maintenance Station SF and I-605/SR-91 EDB, respectively. The previous rainfall, for all stations, occurred on April 1, 1999, approximately 4.5 days before this storm event. The previous rain was insufficient to warrant a mobilization effort (0.07 inches to 0.17 inches).

1.1.2.4 Rainfall Data - Event 4 (April 11, 1999)

The third and last storm event of the 1998/1999-storm season occurred on April 11, 1999. This storm represented the largest amount of rainfall for the three monitored storms this season. Samples were collected at three sites (I-5/I-605 EDB, I-605/SR-91 EDB, and Foothill Maintenance Station SF). Rainfall totals ranged from 0.85 inches at Foothill Maintenance Station SF to 1.62 inches at I-605/SR-91 EDB. Rain intensity ranged from 0.24 inches/hour to 0.36 inches/hour at Foothill Maintenance Station SF. Duration of the rainfall ranged from approximately 12.5 hours to 13.9 hours at I-605/SR-91 EDB and Foothill Regional Maintenance Station SF, respectively.

1.1.3 Storm Water Runoff During Monitored Events

The flow data reported in this section are from the storm events that were sampled during the 1998/1999-storm season. The two EDBs and the two sand filters were equipped with area-velocity flow meters and bubblers (AVB) to calculate the influent flow. The effluent at the EDBs used a bubbler and a V-notch weir to calculate the flow. The effluent at the sand filters was measured exclusively with a bubbler to calculate the flow through the sump pumps.

The detention times presented in the sections below have been calculated from when the influent flow begins to enter the detention basin and finishes when the effluent flow has stopped. Therefore, detention times are greater than the duration of the effluent flow (effluent flow typically lags several hours behind influent flow).

1.1.3.1 Flow Data – Event 1 (March 20, 1999)

This storm monitoring event was cancelled due to an insufficient amount of rainfall. Therefore, no data was collected for this event.

1.1.3.2 Flow Data - Event 2 (March 25, 1999)

For Event 2, on March 25, 1999, samples were collected at the influent and effluent site of I-605/SR-91 EDB. Samples could not be collected at other operational sites due to light rainfall and runoff, and various equipment malfunctions.

I-605/SR-91 EDB

On March 25, 1999, the influent flow at I-605/SR-91 EDB occurred from approximately 11:31 PST through 16:57 PST, for a duration of 5.4 hours. The reported flow peaked at 0.36 cubic feet/second (cfs) early in the storm immediately following an increase in rainfall intensity (Figure 1.1.3.1) for a total storm volume of 1,402 cubic feet (cf). Flow peaked early during the storm and stopped for a short period, before resuming, briefly. The estimated composite sample captured was 100 percent of the stormwater volume.

The effluent flow occurred from approximately 12:04 PST through 17:37 PST, for a duration of 5.6 hours. The flow peaked at 0.06 cfs for a total volume of 680 cf. This represents a detention time of 6.1 hours. The flow characteristics were similar to those of the influent. The estimated representative storm volume sample captured was 100 percent.

1.1.3.3 Flow Data - Event 3 (April 6, 1999)

For Event 3, on April 6, 1999, samples were collected at the influent and effluent sites of I-5/I-605 EDB, I-605/SR-91 EDB, Eastern Maintenance Station SF, and Foothill Regional Maintenance Station SF.

I-5/I-605 EDB

On April 6, 1999, the influent flow at I-5/I-605 EDB occurred from approximately 0848 PST through 13:49 the following day (April 7, 1999) for a duration of 29 hours. The influent flow responded quickly to rainfall and lack of rainfall (Figure 1.1.3.2). The flow peaked at 0.41 cfs for a total storm volume of 6,511 cf. The estimated representative storm volume sample captured was 100 percent.

The effluent flow occurred from 12:07 PST April 6, 1999, through 15:52 PST April 8, 1999, for a duration of 51.8 hours. The flow of the effluent exiting the EDB was slow, and trailed the influent reactions by several hours and appeared to buffer the actions of the influent. The flow peaked at 0.01 cfs for a total volume of 1,109 cf. The detention time was approximately 55.1 hours. An apparent problem with the effluent site was the inability of the basin to properly drain because of the small slope of the effluent discharge pipe and the damming action of the weir. Once the level of the water dropped below the V-notch on the weir it became necessary to remove the drain plug (located at the bottom of the weir), to drain the remaining water. Some unknown amount of stormwater was not sampled due to the loss of flow data. The estimated representative storm volume sample captured was 99 percent of the measured effluent flow.

The discrepancy between influent and effluent volumes has two potential causes: (1) The basin did not completely drain due to standing water that had accumulated behind the weir; and (2) the inherent inaccuracies of the Sigma flow meters that were experienced during low flow conditions.

I-605/SR-91 EDB

The influent flow occurred at I-605/SR-91 EDB between 09:08 PST April 6, 1999, and 11:01 PST April 7, 1999, for a duration of approximately 25.9 hours. The flow peaked twice during the storm with a lull between peaks lasting most of a 24-hour day (Figure 1.1.3.3). The peak flow of the entire storm was 0.64 cfs with a total storm volume of 2,216 cf, of which a representative stormwater sample was captured at approximately 100 percent.

The effluent flow occurred between 10:18 PST April 6, 1999 and 13:12 PST April 7, 1999, for a duration of almost 26.9 hours. The flow characteristics were similar to the influent with a lull between two peaks. The flow peaked at 0.55 cfs for a total storm volume of 510 cf. The detention time was approximately 28.1 hours. The representative captured sample was estimated to be 100 percent of the stormwater.

Eastern Regional Maintenance Station SF

The influent flow occurred at Eastern Regional Maintenance Station SF between 08:19 PST April 6, 1999 and 12:22 PST April 7, 1999, for a duration of approximately 28.1 hours. As noted with the EDBs the storm was quiet for several hours, halfway through the storm. As the intensity of the rain increased, influent flow increased (Figure 1.1.3.4). The flow peaked at 0.15 cfs for a total stormwater influent volume of 4,374 cf. The captured sample, a representative volume of the total stormwater, was estimated at 95 percent.

The effluent flow occurs at the Eastern Maintenance Station SF when the sump level rises to a pre-determined level causing a float switch to activate the sump pump. The level at which this occurs is approximately 3.5 feet. The combination of the sediment basin and the sand media appeared to buffer the effects of the influent stormwater upon the effluent discharge. The peak effluent flow (0.23 cfs) is driven by the pump rate and generally will not vary significantly. Total stormwater volume was reported as 8,196 cf. The detention time was approximately 45.4 hours. The representative storm volume sample captured was estimated at 79 percent.

It should be noted that the algorithm used to calculate pump discharge rates failed to consider the frictional losses attributed to the discharge pipes. This was corrected immediately after the 1998/1999 storm season.

Foothill Maintenance Station SF

The influent flow occurred at Foothill Maintenance Station SF between 09:42 PST April 6, 1999 and 11:13 PST April 7, 1999, for a duration of approximately 25.5 hours. As with the previous stations the influent reacted quickly to rainfall intensity (Figure 1.1.3.5). Most of the flow occurred during the beginning with periods of activity during infrequent showers. The peak influent flow was 0.59 cfs, with a stormwater volume of 6,883 cf. The representative storm volume sample captured was estimated at 99 percent.

The effluent flow occurs at the Foothill Regional Maintenance Station SF operates exactly as the Eastern Maintenance Station SF. The level at which the sump pump is triggered is approximately 4.5 feet. The combination of the sediment basin and the sand media appeared to buffer the effects of the influent stormwater upon the effluent discharge. The peak effluent flow (0.23 cfs) is driven by the pump rate and generally will not vary significantly. Total stormwater volume was reported as 22,805 cf. The detention time was approximately 44.3 hours. The representative storm volume sample captured was estimated at 95 percent.

It should be noted that the algorithm used to calculate pump discharge rates failed to consider the frictional losses attributed to the discharge pipes. This was corrected immediately after the 1998/1999 storm season.

1.1.3.4 Flow Data - Event 4 (April 11, 1999)

For Event 4, on April 6, 1999, samples were collected at the influent and effluent stations of the I-5/I-605 EDB, I-605/SR-91 EDB, and Foothill Maintenance Station SF.

I-5/I-605 EDB

On April 11, 1999, the influent flow at I-5/I-605 EDB occurred from approximately 14:46 PST through 21:58 PST, for a duration of 7.2 hours. The intensity of the rainfall was low at the beginning of the storm and the influent flow built up correspondingly (Figure 1.1.3.2 – Note that the figures for cumulative rainfall and influent flow have a different timeline than the one used for the effluent flow). The flow peaked at 0.98 cfs for a total storm volume of 12,084 cf. The estimated representative storm volume sample captured was 87 percent.

The effluent flow occurred from 17:0 PST April 11, 1999, through 15:55 PST April 16, 1999, for a duration of approximately 118.9 hours. The flow of the effluent exiting the EDB was slow, and trailed the influent reactions by several hours buffering the actions of the influent. In order to drain the basin and measure the flow, effectively, the bubbler was removed from upstream of the weir once the stage had dropped to the bottom of the V-notch. The bubbler was than attached downstream of the weir and the drain plug was removed at approximately 09:45 PST on April 15, 1999. Appropriate modifications to the software allowed for the different calculations. Therefore the data, represented in Figure 1.1.3.6, has a significant increase in flow several days after the end of the storm. The flow first peaked at 0.07 cf while the drain plug remained in the weir. After it was removed the flow reached a peak of 0.13 cfs for a total volume of 13,796 cf. The detention time was approximately 121.2 hours. The estimated representative storm volume sample captured was 75 percent of the measured flow.

I-605/SR-91 EDB

The influent flow occurred at I-605/SR-91 EDB between 14:34 PST April 11, 1999, and 21:48 PST April 11, 1999, for a duration of approximately 7.2 hours. The flow gradually increased as the storm intensified (Figure 1.1.3.7). The peak flow of the entire storm was 1.40 cfs with a total storm volume of 7,160 cf, of which a representative stormwater sample was captured at approximately 70 percent.

The effluent flow occurred between 15:28 PST April 11, 1999 and 06:20 PST April 12, 1999, for a duration of 14.9 hours. The flow peaked at 1.02 cfs for a total storm volume of 1,964 cf. The detention time was approximately 15.8 hours. The representative captured sample was estimated to be 97 percent of the stormwater.

Foothill Maintenance Station SF

The influent flow occurred at Foothill Maintenance Station SF between 13:27 PST April 11, 1999 and 02:51 PST April 12, 1999, for a duration of approximately 13.4 hours. As before the influent reacted quickly to rainfall intensity (Figure 1.1.3.8). The peak influent flow was 0.41 cfs, with a stormwater volume of 4,381 cf. The representative storm volume sample captured was estimated at 100 percent.

The peak effluent flow (0.21 cfs) is driven by the pump rate and generally will not vary significantly. It appeared that the pump stayed on for long periods of time as the level of the sump reached equilibrium. Apparently the inflow into the sump was great enough that it the pump never discharged enough water to cause the lower limit float switch to trigger off. Total stormwater volume was reported as 17,995 cf. The detention time was approximately 33.6 hours. The representative storm volume sample captured was estimated at 99 percent.

It should be noted that the algorithm used to calculate pump discharge rates failed to consider the frictional losses attributed to the discharge pipes. This was corrected immediately after the 1998/1999 storm season.

Summary

Throughout these first events, many flow-measuring anomalies were recorded. Factors that contributed to erroneous volume calculations or results included infiltration, structural leakage, instrumentation inaccuracies under low flow and turbulent conditions, and hydraulic interferences.

As discussed at length in the sections that follow, corrective action, adjustments, and calibrations are currently underway to maximize flow-measuring accuracy and will be in place for 1999/2000 monitoring events.

1.2 Water Quality Analyses

All stormwater analyses were conducted by a certified laboratory under the California Environmental Laboratory Accreditation Program (ELAP). The analyses were performed in substantial accordance with the methods and procedures as outlined in the *Operation, Maintenance, and Monitoring Plan, District 7, Volume II* (i.e., OMM Guidance - Quality Assurance Project Plan) and as specified by applicable EPA methods. Table 1.2.1 summarizes the laboratory analyses performed on stormwater samples collected from the four BMPs that operated during the latter months of the 1998/1999 rain season (March-April). Analytical results are discussed in Section 1.3

Table 1.2.1
Analytical Methods Summary, District 7 BMPs, Brown and Caldwell

Analyte	Sample Type	Analytical Method
Conventionals		
pH	Composite	EPA 150.1
Specific Conductance	Composite	EPA 120.1
Hardness	Composite	EPA 130.2
TSS	Composite	EPA 160.2
Nutrients		
Nitrate-N	Composite	EPA 300
TKN	Composite	EPA 351.1
Total Phosphorous	Composite	EPA 365.3
Total/Dissolved Metals		
Copper	Composite	EPA 200.8
Lead	Composite	EPA 200.8
Zinc	Composite	EPA 200.8
Organics		
TPH -diesel	Grab	EPA 8015M
TPH -oil	Grab	EPA 8015M
TPH-gasoline	Grab	EPA 8015M
Bacteria		
Fecal Coliform	Grab	SM 9221E

1.2.1 Quality Assurance/Quality Control Procedures

Quality Assurance/Quality Control (QA/QC) procedures were followed and performed by field and laboratory personnel to provide quality control checks on the representativeness of the environmental samples (i.e., stormwater) collected, the precision of sample collection and handling procedures, and the precision and accuracy of the laboratory procedures. The following section provides a summary of these procedures.

1.2.1.1 Data Quality Control (QC) Overview

Sample and data quality control (QC) measures consisted of the following elements:

- Standard procedures were followed for sample collection, identification, labeling and packaging.
- Blind field QC samples were collected for each type of sample analyzed (if applicable) for each storm event. These samples included field blanks and field duplicates. Additionally, sufficient sample volumes were submitted to the laboratory to ensure that at least one set of matrix spikes (MS/MSD) and laboratory split sample analyses was performed for each storm event.
- Customized chain-of-custody forms listing the specific analyses and method required for each BMP type were used which documented the transfer of samples from the field to the laboratory.
- Standard procedures were followed for sample compositing, splitting, preparation and analysis.
- Quality control measurements were performed by the laboratory in accordance with the OMM Guidance - Quality Assurance Project Plan specifications. These measurements includes the analyses of blanks (i.e., method blanks, filter blanks, equipment blanks, and bottle blanks), laboratory control sample (LCS), MS and MSD samples, and surrogate spikes, if applicable. Note that MS/MSD analyses were always performed on a project sample.
- Pre-defined standards were in place for all QC measurements in accordance with the data quality objectives outlined in the OMM Guidance - Quality Assurance Project Plan.
- Final data packages were submitted by the laboratories and reviewed by Brown and Caldwell project staff. These packages included final analysis results as well as electronic data deliverables (EDDs) in a format consistent with the 1998-99 Data-Reporting Protocols.
- Second-party review was completed of all results and calculations prior to reporting from the laboratory.
- Brown and Caldwell project staff review was completed for all results and supporting QC measurements submitted by the laboratories.
- One hundred percent verification of all data presented in the report against the hard copy laboratory report and EDD was completed by Brown and Caldwell project staff.

The implementation of these procedures was monitored during each storm event to ensure compliance with the requirements specified in OMM Guidance - Quality Assurance Project Plan. Field activities were monitored through the use of field QC samples and evaluation of field documentation, which included the use of field notebooks and monitoring forms. Laboratory data quality was assessed using laboratory QC samples and measurements, and the data were assessed for conformance with project-specific standards. The results of this evaluation are presented in Section 1.3.1.

1.3 Water Quality Results

Water Quality Results for the four BMP sites monitored to date are presented in Table 1.3.1. Although Brown and Caldwell staff has mobilized for a total of four separate storm events (March 20, March 25, April 6, and April 11), the first storm did not generate sufficient runoff to allow the collection of paired stormwater samples. As indicated in Table 1.3.1, the subsequent events were to some extent successful in that at least one or more BMP sites could be evaluated with respect to water quality data.

In general monitoring results for effluent samples collected from the four BMP sites show a decrease in concentration for most analytes. However, some exceptions were noted in the data where higher concentrations of some analytes (i.e., diesel and oil) have been observed (Table 1.3.1) in the effluent sample. No evidence of equipment, field and/or laboratory contamination that could have contributed to the higher concentrations at the effluent station was noted in the blank sample analyses performed by the laboratory. Refer to the following sections for further discussion on quality control sample results and water quality data interpretation.

1.3.1 Assessment of Quality Assurance/Quality Control Results

The following sections provide a summary of the QA/QC review for field and laboratory analytical data generated during the latter months of the 1998/1999 rain season. This review as presented below represents the first step (data verification) in the data validation process by which results are validated for overall accuracy, precision, and representativeness to establish data quality and usability. The approach used in the validation process involves the review of chain-of-custody forms, preparation, and use of checklists, which detail the required QC for each respective analytical method; verification and documentation of compliance with the applicable criteria; and, finally, assignment of qualifiers to sample results associated with QC samples that did not meet the validation criteria.

The assessment below is intended to provide a synopsis of any significant problems identified during the data verification step that may lead to data qualification (i.e., assignment of qualifiers) during the latter portion of the validation process. The evaluation on whether or not qualification of the data is deemed necessary will follow the basic guidelines from the United States Environmental Protection Agency (EPA) for evaluating inorganic and organic analysis (EPA February 1994a; EPA, 1994b). A comprehensive discussion of this evaluation and the data validation results will be presented in a later comprehensive report.

Table 1.3.1
BMP Retrofit Pilot Study District 7, Stormwater Analytical Data

Sample Date	Location	Site ID	BMP Type	% Storm Capture	pH	Specific Conductance (mmhos/cm)	Hardness (mg/L)	TSS (mg/L)	Total (mg/L) Cu	Total (mg/L) Pb	Total (mg/L) Zn	Dissolved (mg/L) Cu	Dissolved (mg/L) Pb	Dissolved (mg/L) Zn	Nitrate Nitrogen(1) (mg/L)	TKN(1) (mg/L)	Total P(1) (mg/L)	Fecal Coliform (MPN/100mL)	TPH Diesel (mg/L)	TPH Gasoline (mg/L)	TPH Oil (mg/L)
25-Mar-99	I-5/I-605 Intersection	074101	EDB (2) - Influent	100	NR	NR	—	—	—	—	—	—	—	—	NR	—	—	1600(3)	—	—	—
25-Mar-99	I-5/I-605 Intersection	074101	EDB (2) - Effluent	0	—	—	—	—	—	—	—	—	—	—	—	—	—	900(3)	—	—	—
25-Mar-99	I-605/SR-91 Intersection	074102	EDB (2) - Influent	100	7.7	110	76	85	56.0	190.0	390.0	15.0	6.2	130.0	1.00	1.8	0.330	900	2900	<50	1300
25-Mar-99	I-605/SR-91 Intersection	074102	EDB (2) - Effluent	100	7.5	190	62	59	37.0	120.0	260.0	14.0	2.0	130.0	2.10	3.4	0.780	500	2900	<50	1100
25-Mar-99	Foothill Maintenance Station	074203	Media Filter - Influent	100	NR	NR	—	—	—	—	—	—	—	—	NR	—	—	>1600(3)	—	—	—
25-Mar-99	Foothill Maintenance Station	074203	Media Filter - Effluen	0	—	—	—	—	—	—	—	—	—	—	—	—	—	<2(3)	—	—	—
6-Apr-99	I-5/I-605 Intersection	074101	EDB (2) - Influent	100	7.2	160	48	71	34.0	88.0	200.0	17.0	5.5	72.0	0.84	2.0	0.410	1600	2200	<50	1300
6-Apr-99	I-5/I-605 Intersection	074101	EDB (2) - Effluent	99	7.3	190	44	44	30.0	63.0	140.0	19.0	2.5	68.0	0.81	2.0	0.450	300	3000	<50	1300
6-Apr-99	I-605/SR-91 Intersection	074102	EDB (2) - Influent	100	7.4	120	38	80	50.0	250.0	310.0	13.0	11.0	73.0	0.88	2.4	0.170	>1600	3900	<50	2000
6-Apr-99	I-605/SR-91 Intersection	074102	EDB (2) - Effluent	100	7.3	200	62	49	30.0	140.0	220.0	12.0	3.5	88.0	2.00	2.9	0.860	>1600	5200	<50	3800
6-Apr-99	Eastern Regional Maintenanc	074202	Media Filter - Influent	95	6.9	85	24	57	19.0	37.0	130.0	10.0	2.1	37.0	0.68	0.9	0.150	900	1200	<50	640
6-Apr-99	Eastern Regional Maintenanc	074202	Media Filter - Effluen	79	7.1	82	24	20	11.0	11.0	36.0	7.8	1.4	12.0	0.77	1.0	0.088	110	1100	<50	450
6-Apr-99	Foothill Maintenance Station	074203	Media Filter - Influent	99	6.6	49	22	120	42.0	45.0	340.0	19.0	1.3	110.0	0.37	1.4	0.320	500	1000	<50	320
6-Apr-99	Foothill Maintenance Station	074203	Media Filter - Effluen	95	7.0	80	26	21	18.0	6.4	45.0	14.0	<1.0	21.0	0.43	0.6	0.090	<2	500	<50	<200
11-Apr-99	I-5/I-605 Intersection	074101	EDB (2) - Influent	87	7.2	79	24	48	21.0	60.0	140.0	8.7	3.6	40.0	0.52	1.5	0.210	500	2000	<50	1200
11-Apr-99	I-5/I-605 Intersection	074101	EDB (2) - Effluent	75	7.4	86	24	12	11.0	17.0	41.0	8.1	1.5	53.0	0.56	1.0	<0.03	2	1200	<50	510
11-Apr-99	I-605/SR-91 Intersection	074102	EDB (2) - Influent	70	7.5	63	21	61	30.0	99.0	240.0	7.4	3.8	56.0	0.44	1.8	0.029	110	3600	<50	2100
11-Apr-99	I-605/SR-91 Intersection	074102	EDB (2) - Effluent	97	7.5	95	28	94	19.0	47.0	99.0	6.7	2.0	43.0	0.74	1.6	0.340	500	3900	<50	2200
11-Apr-99	Eastern Regional Maintenanc	074202	Media Filter - Influent	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	900	1300	<50	670
11-Apr-99	Eastern Regional Maintenanc	074202	Media Filter - Effluen	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	90	630	<50	210
11-Apr-99	Foothill Maintenance Station	074203	Media Filter - Influent	100	7.1	59	16	68	28.0	21.0	220.0	24.0	2.9	120.0	0.37	1.2	0.180	>1600	940	<50	560
11-Apr-99	Foothill Maintenance Station	074203	Media Filter - Effluen	99	7.2	88	30	11	17.0	3.7	33.0	15.0	<1.0	21.0	0.35	0.7	0.080	>1600	570	<50	<200

(1) Analysis requested for samples from drain inlet inserts beginning on 3/25/99 by Caltrans but not required as part of OMM Plan. These analyses will be required in a revised OMM plan before the next wet season.
(2) Extended Detention Basin.
(3) Although event was not successful, analyses were performed to comply with holding time requirements.

NR - Not Reported. Analysis was performed to comply with holding time requirements. However, paired samples were not successfully collected.
NA - Not Analyzed

1.3.1.1 Summary of QA/QC Review

As previously mentioned QC samples were collected during each storm event. Prior to each event a QC schedule was developed to determine the type of QC samples to be collected at each site in a manner to satisfy the requirements outlined in the OMM Guidance – Quality Assurance Project Plan. Given the constraints associated with the collection of stormwater samples, the QC schedule was designed to accommodate at least four separate plans in case sufficient sample volume was not obtained from the designated QC station. Table 1.3.1.1 presents a summary of the actual QC schedule applied during the three storm events monitored.

Table 1.3.1.1
Quality Control Sample Schedule, 1998/1999 Wet Season

Site	March 25, 1999	April 6, 1999	April 11, 1999
I-5/I-605 EDB	None	None	Field Duplicate; MS/MSD
I-605/SR-91 EDB	Field Duplicate; MS/MSD; Field Blank	Field Blank	Lab Split
Eastern Regional SF	Lab Split	Lab Split	Field Blank
Foothill SF	None	Field Duplicate; MS/MSD	None

In general, QC sample measurements were of sufficient quality to meet the data quality objectives of the project except as discussed below.

Holding Times

Holding times were met for all samples except for bacteriological analyses (fecal coliform) performed on samples collected during the March 25 storm event. During that event, samples from all four BMPs were analyzed beyond the six-hour allowable holding time but within the twenty four-hour technical holding time in accordance with *the Standard Methods for the Examination of Water and Wastewater, 18th Edition*. Although, the few hours exceedance do not affect the overall data interpretation in this report, the results associated with these samples should be considered as an approximation of actual concentrations and therefore will be qualified as estimated quantities during the latter portion of the validation process.

Project Detection Limits

Table 1.3.1.2 provides the RDLs achieved by the laboratory, which are compared to the target RDLs proposed by LWA.

Blank Sample Analyses

All blanks were prepared in accordance with the project specifications as outlined in the OMM Guidance – Quality Assurance Project Plan. Blank sample results were evaluated to determine whether contamination was introduced as a result of sample equipment contribution (sampling hose and tubing blanks, and composite bottle blanks) and/or field and analytical procedures (field blanks, trip blanks, filter blanks and method blanks). A preliminary review of these blank data does not indicate any systematic contamination problems. In general, field- and laboratory-generated blanks were free of any target analytes. However, the detection of concentrations near the RDLs for metals (i.e., lead and zinc) in some of the sample equipment blanks may result in the addition of qualifiers to associated sample results. The determination of whether data will be qualified on the basis of blank contamination will depend on the evaluation of blank concentrations with respect to concentrations detected in the associated environmental samples. Associated positive sample results that are less than 5 times or 10 times (10 times is only applicable to metals or any common laboratory contaminants) the amount found in the blank will be qualified accordingly to avoid the potential positive bias. It is anticipated that the detection of metals in some of the blanks will affect results for the dissolved fraction.

Precision, Accuracy, and Representativeness

While the results of field duplicates analysis are used to measure field and laboratory precision, the analysis of split samples are used to measure the reproducibility of laboratory replicates under a given set of conditions. Precision is expressed in terms related to the mean concentration (relative percent difference - RPD) for field duplicates, laboratory splits and MS/MSD analysis. Preliminary review of the data generated during the 1998/1999 rain season indicated that MS/MSD RPD values were all within the acceptance criteria for precision. In general, field duplicates and laboratory splits are within these criteria. However, a through evaluation and interpretation of these results will be presented in a later comprehensive report.

Table 1.3.1.2
Reporting Detection Limits, Caltrans District 7 Retrofit Pilot Program

Analysis	Units	Method	BMP Required Reporting Limits (LWA 1997)	Del Mar Analytical Reporting Limits	Comment
pH	Unit	EPA 150.1	0.1	0.1	
Specific Conductance	umhos/cm	EPA 120.1	1	1	
Hardness	mg/L	EPA 130.2	2	2	
TSS	mg/L	EPA 160.2	1	1	1 mg/L provided that sample volume equals 1 liter. Otherwise, reporting limit will default to 10 mg/L.
Nitrate-Nitrogen	mg/L	EPA 300	0.01	0.11	Variability of method prohibits RL of 0.01.
TKN	mg/L	EPA 351.3	0.1	0.1	
Total P	mg/L	EPA 365.3	0.002	0.03	Variability of method prohibits RL of 0.002.
Copper	ug/L	EPA 200.8	1	1	
Lead	ug/L	EPA 200.8	1	1	
Zinc	ug/L	EPA 200.8	1	5	Method blank contamination at <5 ug/L is very possible and may render data to be flagged during the validation process.
TPH-Gasoline	ug/L	EPA 8015M	50	50	
TPH-Diesel	ug/L	EPA 8015M	100	100	
TPH-Oil	ug/L	EPA 8015M	200	200	
Oil & Grease	mg/L	EPA 413.2	5	5	
Fecal Coliform	mpn/100mL	SM 9221E	200	200	

Accuracy is expressed as the percent recovery for both laboratory control samples (LCS), matrix spikes (MS/MSD), and surrogate spikes (where applicable). The laboratory control sample serves as a monitor of the overall performance of all steps in the analysis, including sample preparation. Matrix spike sample analysis provides information about the effect of each sample matrix on the sample preparation and determination methodology. Surrogate spike recovery measures accuracy in terms of sample extraction efficiency (organic compounds only). In general, all accuracy values were within the acceptance criteria, except for surrogate recoveries associated with total petroleum hydrocarbon (TPH) analyses for diesel and oil. Percent recoveries for some of these analyses were reported above the laboratory upper control limit. This problem is believed to be the result of matrix interference caused by elevated TPH concentrations in the samples. In fact, the high TPH concentrations detected in some samples caused the surrogate spike to be diluted out. A detailed evaluation of surrogate spike recoveries in conjunction with other data accuracy measurements (i.e., matrix spikes and LCS data) will be performed to determine whether data qualification is deemed necessary. Results of this evaluation will be presented in a later comprehensive report.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter, variations at a sampling point, a process condition or an environmental condition. Sample identity and integrity were maintained using the documentation and custody procedures, and by adhering to the preservation, storage, and holding times specified in the OMM Guidance.

1.3.1.2 Trace Metals and Hardness

Results for trace metal analyses are generally showing a decrease in concentration at the effluent sampling point at all four BMP sites. Some exceptions have been observed at the two EDBs during the last monitoring event where zinc concentrations actually increased after treatment. This increase, however, does not appear to effect the overall data interpretation. In general, metal concentrations were higher during the first two storms (March 25 and April 6).

Hardness results are generally less variable than the metals, showing nearly no decrease in concentration at the effluent sampling point. Data collected during the April 6 event at the I-605/SR-91 EDB and the April 11 event at Foothill MS SF show an increase in concentration at the effluent sampling point. Additional monitoring data may help identified, if any, data trends for this analyte.

1.3.1.3 Conventional and Other Contaminants

Except for total phosphorous, the data do not show any significant decrease in concentration after treatment for nutrient analyses. Total phosphorous results associated with three of the BMP sites (I-5/I-605 Intersection, Foothill MS, and Eastern Regional MS) monitored, show a significant decrease in concentration after treatment (i.e., one order of magnitude). This decrease in concentration is not observed for the I-605/SR-91effluent samples collected from any of the three monitoring events.

TPH diesel and oil have been observed at all BMP sites with concentrations ranging from lowest at the Foothill MS to highest at the I-605/SR-91 Intersection. Increased in TPH concentrations (diesel and oil) at the effluent sampling point have been detected at the two EDB sites. At I-605/SR-91, this increase in concentration is shown in samples collected during all three monitoring events. Generally the detection of TPH at all four BMPs is consistent with oil sheen observed at these sites.

Fecal coliform results are scattered and varied significantly among BMPs and the different monitoring events. No concentration pattern is observed at this time. Future monitoring data may help in the interpretation of bacteriological data.

1.3.2 Preliminary BMP Performance Evaluations

Plot diagrams of metals, TPH (diesel and oil), and bacteriological data are shown on Figures 1.3.2.1 through 1.3.2.20. As indicated by a consistent pattern observed in these plots, there is an overall reduction in concentration of metals after treatment at all BMPs. Among the BMP types monitored to date, metals concentrations appear to have decreased the most at the Foothill MS BMP (Figures 1.3.2.7 through 1.3.2.9). Between the two EDB BMPs, however, I-605/SR-91 appears to be more efficient in reducing the metals at this time.

In contrast with the metals data, elevated TPH results for both diesel and oil fractions have been detected in samples collected after treatment (effluent sample) during most of the monitoring events at the I-605/SR-91 (Figure 1.3.2.19). Eastern Regional MS (Figure 1.3.2.15) and Foothill MS (Figure 1.3.2.17) are showing reductions of TPH (diesel and oil), but this trend is based only two storm events. TPH gasoline fraction has not been detected in any of the BMPs.

As previously mentioned, bacteriological data collected to date (Figures 1.3.2.14, 1.3.2.16, 1.3.2.18, and 1.3.2.20) do not show a trend in concentrations to support an evaluation of any of the BMPs at this time. Among the nutrient analysis results, with the exception of I-605/SR-91, total phosphorous appears to be the only analyte where significant reduction concentration is occurring. At I-605/SR-91, total phosphorous concentrations have consistently increased after treatment. It is not clear at this time why this is occurring.

In summary, the data collected during the latter portion of the 1998/1999 rain season indicates that all four BMPs monitored to date are performing as anticipated in the reduction of metals. However, these BMPs do not appear to be performing as well with respect to the other constituents. Additional monitoring data will be used to drawn final performance evaluation regarding the different BMP types.

2.0 BMP OPERATIONS

Operational parameters of BMPs were recorded on field log sheets in accordance with prescribed guidance presented in the *Operation, Maintenance, and Monitoring Plan, District 7, Volume II* (i.e., OMM Guidance). Assessment of BMP operational performance was determined using empirical observations (Form H of the OMM Guidance). Empirical observations were taken at variable times for each monitored event, which were sometimes hampered by traffic, weather, and insufficient light.

2.1 Introduction and Methods

Under the scope of this program, Brown and Caldwell is responsible for monitoring 10 BMP facilities in District 7, which include:

- Two extended detention basins (EDB), sites 74101 & 74102,
- One oil/water separator (OWS), site 74201,
- Four sand filters (SF), sites 74104, 74202, 74203, 74204, and
- Three multi-chambered treatment trains (MCTT), sites 74103, 74206 and 74207.

Monitoring of BMP operations began with the satisfactory completion of construction, and after automated monitoring instrumentation was adequately installed. During the latter months of the 1998/1999 rain season (March—April), monitoring of BMP operations were initiated at the following District 7 locations:

1. SF Site 74202 (Eastern Regional Maintenance Station), which was operational the week of February 8, 1999,
2. EDB Site 74102 (I-605/SR-95), which was operational the week of February 15, 1999,
3. EDB Site 74101 (I-5/I-605) , which was operational the week of February 15, 1999, and
4. SF Site 74203 (Foothill Maintenance Station), which was operational the week of March 1, 1999.

Operational dates provided above denote periods when monitoring instrumentation was largely complete and event monitoring was initiated. However, adjustments to equipment programming and instrumentation continued throughout the wet-season period. Through this initial break-in period, various adjustments or modifications became necessary to optimize or correct BMP performance. These situations are described in more detail in the sections that follow.

Empirical observations that were recorded for the four BMPs that operated during the late 1998/1999 storm season, included:

- Meteorological characteristics (rainfall presence and intensity [refer to Section 1]),
- Hydrological and hydraulic characteristics,
- Inlet conditions,
- Water quality appearance,
- Solids deposition and re-suspension,
- Outlet conditions,

- Mosquitoes and other vectors,
- Structural condition of the facility, and
- Monitoring equipment conditions.

In addition, other site-specific BMP observations recorded included:

- Erosion and vegetation conditions at EDBs (I-5/I-605 and I-605/SR-91), and
- Treatment medium (sand) conditions at sand filters (Eastern Regional and Foothill Maintenance Stations).

Four additional BMP facilities that came online after the 1998/1999 wet season, for which no storm monitoring data has been collected, included:

5. SF Site 74204 (Termination Park and Ride) operational the week of April 19, 1999,
6. OWS Site 74201 (Alameda Maintenance Station), operational the week of April 26, 1999,
7. MCTT Site 74206 (Via Verde Park and Ride) operational the week of May 3, 1999, and
8. MCTT Site 74208 (Lakewood Park and Ride) operational the week of May 3, 1999.

Two additional BMPs are expected to be completed in early 2000, which include:

9. SF Site 74103 (Paxton Park and Ride) and
10. MCTT Site 74104 (Metro Maintenance Station).

2.2 Summary of Empirical Observations and BMP Methods

Empirical observations were collected in accordance with established OMM guidance (Form H). Synoptic discussions of these observations by Brown and Caldwell during the 1998/1999-storm season are discussed in the sections below.

2.2.1 Extended Detention Basin

The results of empirical observations at operational EDB sites during the 1998/1998-rain season are summarized for sites 74101 (I-5/I-605) and 74102 (I-605/SR-91).

2.2.1.1 Site 74101 – Extended Detention Basin, I-5/I-605

Hydraulic Characteristics

Water flow into and out of the basin occurred as designed. However, standing water tends to accumulate in the discharge outlet structure. Adjustments to the outlet structure are necessary to eliminate standing water and discharge pipe characteristics need modification to improve suitable outlet flow monitoring under low-flow conditions. Detention characteristics were otherwise normal and the basin functioned properly. See Section 1.1.3 for additional details and discussion on other hydraulic characteristics.

Inlet Conditions

Flow entering the facility was observed to occur as designed. On occasion, water backed up into the inlet structure during periodic runoff peaks, but was not sufficient to induce inflow bypassing. The immediate inlet structure area was found to accumulate varying degrees of trash, which usually consisted of cigarette butts and organic debris.

Water Quality

Storm water in the basin was generally a translucent greenish-brown with some cloudiness. Surface films were common, ranging from dust and organic material (plant matter) on the water surface to petroleum sheens. An oily sheen was evident during most storm events, particularly earlier in the season.

Trash tended to concentrate around the inlet structure rip-rap, whereas organic material was apparent over the entire basin (straw, grass cuttings, etc.). Flotsam was noted on several events. No odor was detected.

Solids Deposition and Resuspension

Due to the short operational life of this facility, sedimentation has been light and is concentrated near the downgradient discharge structure. Resuspension of sediment has not typically occurred due to the distance from the inlet and accumulated sediment near the outlet area.

Erosion

Concrete lining of the basin floor and inside slopes minimizes erosion potential. There was no apparent erosion observed at this site. The operational integrity of this EDB will not be significantly jeopardized by site erosion.

Vegetation Conditions

The hydroseeded vegetation took hold over the course of the season and provided good ground-cover protection. Some bare spots were noted throughout monitoring. Vegetation will be cut in June 1999, with seasonal growth expected to return with wet weather conditions.

Outlet Conditions

Flow from the outlet structure occurred as designed. Some minor standing water collects in the concrete discharge structure.

Attempts to monitor discharge flow during light storm events proved difficult due to very shallow flow over electronic flow sensors. Therefore, a V-notch weir was installed in the discharge pipe to promote greater water depth over the flow sensor during light outflow, which improved accuracy of instrumentation readings. Consequently, water retained behind the weir caused standing water in the basin due to the extremely flat topography of this site. In turn, the weir drain plug was removed (after several days) to allow the basin to completely drain, which compromised outflow measurement accuracy. Flow measurement configuration is currently under re-design, and will be incorporated for the 1999/2000-storm season.

Mosquitoes and Other Vectors

There have been minor occurrences of mosquito egg rafts and other mosquito activity noted by vector experts. Upon notification, areas of standing water were pumped out to mitigate vector breeding. There were no vector problems evident during monitoring events. Waterfowl (ducks) were observed in the basin on one occasion.

Structural Integrity

There were no structural issues at this concrete-lined detention basin. However, there are minor drainage problems downgradient of the BMP discharge outfall. Improvements to stormwater conveyance and overland flow are being implemented over the dry season.

Graffiti was observed near the site, but not within the facility.

2.2.1.2 Site 74102 – Extended Detention Basin, I-605/SR-91

Hydraulic Characteristics

Based on visual characteristics and sampling results, flow through this earthen basin is occurring too quickly. Detention times in the basin ranged from 6.27 hours to 28.07 hours for rainfalls ranging between 0.58 inches and 1.62 inches, which indicates that the basin is draining quicker than desired (based upon a 72-hour design). The design engineer is being consulted to improve the efficiency of the basin. See Section 1.1.3 for additional details and discussion on other hydraulic characteristics.

Inlet Conditions

The inlet structure functioned properly during each monitored storm event. Sediment accumulation within the inlet pipe was noted, which may require maintenance attention during the next monitoring season. No abnormalities with inlet conditions were noted.

There were varying degrees of trash entering the basin. Usually consisting of cigarette butts and floating paper trash. The majority of trash usually collected at the inlet rip-rap and did not spread over the entire basin. The entrapment of flotsam at the inlet was observed to partially backup inflow. Trash management during significant storms may be an issue at this EDB.

Water Quality

Oily sheens were noted, but did not appear to be persistent throughout the storms monitored (more noticeable at the onset of the wet season and less noticeable later in the season). Storm water in the basin was generally brown and cloudy, but transparent under light flow conditions. No odor was detected.

Solids Deposition and Resuspension

Because this facility is an earthen basin, the deposition of sediment is not readily apparent without monitoring accumulation relative to gauging stakes. During the short monitoring season, no significant buildup of sediment was measured.

Resuspension at this EDB may be a concern with larger storms than were experienced during the 1998/1999 monitoring year. The largest storms that occurred (around 1 inch of accumulation) were found to induce a slight scouring effect along the longitudinal flow path from inlet to outlet, which appears to promote sedimentation in effluent samples.

Erosion

As noted above, some degree of erosion was evident in the bottom of the basin, where the incoming water "channels" towards the outlet. However, soil stabilization throughout the basin inner and outer slopes was good. No rilling was apparent, but sedimentation on the driveway below the BMP was observed.

It is important to note that this site serves as a construction storage area, as well as a BMP facility. Throughout the life to this BMP, various construction contractors have occupied the right-of-way area west of the BMP. During recent maintenance surveys, outer and inner slope rutting was found, which is suspected to be from vehicle activity in and around the EDB. Further hydroseeding may be necessary in fall to repair and cover exposed areas.

Vegetation Conditions

The hydroseeded vegetation took hold over the course of the wet season and provided good ground-cover protection. However, some bare spots were noted throughout monitoring. Vegetation will be cut in June 1999, with seasonal growth expected to return with wet weather conditions.

Outlet Conditions

The outlet functioned properly and did not experience any fouling or blockages, but rather appeared to allow water to pass through the facility too rapidly. Although stormwater flows through the basin and discharge structure occurred as designed, the drainage standpipe weep holes may need modification to reduce flow-through and increase residence time. This condition will be addressed and corrected before the onset of the 1999/2000 wet season.

Mosquitoes and Other Vectors

There were no vector problems noted during 1998/1999 monitored storms.

Structural Integrity

During the 19998/1999 storm events, no structural problems were noted. However, recent vehicle traffic in and on this BMP is of concern (see Erosion section above).

2.2.2 Oil/Water Separator

2.2.2.1 Site 74201 – Oil/Water Separator, Alameda Maintenance Station

The OWS at Alameda Maintenance Station came online during the week of April 26, 1999, and was not monitored during the 1998/1999-storm season. No data is available to report.

2.2.3 Sand Filter Type I

Brown and Caldwell monitored two sand filters during the 1998/1999 rain season: site 74202 (Eastern Regional Maintenance Station) and site 74203 (Foothill Maintenance Station). Two other sand filters, site 74103 (Paxton Park and Ride) and site 7204 (Termination Park & Ride), will be reported following 1999/2000 monitoring events.

2.2.3.1 Site 74103 (Paxton Park and Ride)

This facility has not been constructed. No data is available to report.

2.2.3.2 Site 74202 – Sand Filter, Eastern Regional Maintenance Station

Hydraulic Characteristics

Empirical observations have been collected for four principal storms during the 1998/1999 wet season. For each of these events, hydraulic flow from the sediment chamber through the weep pipe to the sand filter weir appeared consistent. On all occasions, overflow from the weir plate to the sand bed was mostly limited to the area closest to the inflow junction of the sediment chamber weep pipe (west end of weir plate). However, the weir was designed to distribute the flow evenly over the adjacent gravel rip-rap before sheet flowing over the sand. Because overflow was not uniform along the entire weir plate, overflow tended to follow a natural, but limited, pathway toward the collection pump well. Broad and uniform flow over the sand media did not occur, but was rather limited to a narrow tributary directed toward the pump well. See Section 1.1.3 for additional details and discussion on other hydraulic characteristics.

Inlet Conditions

The inlet structure functioned properly during each monitored storm event. No problems were noted. However, electronic flow monitoring at this facility experienced uncontrollable and unforeseen faults that compromised flow data.

Water Quality

The water, in the basin, generally was brown with heavy, opaque cloudiness. Resuspension of accumulated sediment contributed to the apparent opaqueness of the sediment chamber water. A greenish-yellow surface scum was observed in the sedimentation chamber during all monitored events. Petroleum sheens were observed during each event. There was very little trash or organic material entering the basin, a few paper cups, leaves, etc. A chlorine odor was detected at the inflow structure during one event. There was no readily apparent source of the chlorine odor.

Solids Deposition and Resuspension

Slight but consistent sedimentation was observed to build up over time in the sediment chamber. During inflow, sediment that had settled on the chamber floor appeared to be redistributed from inflow agitation in the vicinity of the inflow downspout. This likely attributed to opaque coloration in the sediment chamber water.

Erosion

There are no erosion concerns at this SF facility. The entire site is paved and impervious to rainfall.

Vegetation Conditions

There are no vegetation concerns at this SF facility. The entire site is paved and provides no opportunity for significant vegetative growth. However, as this BMP ages, maverick seeds, spores, or other windblown plant cuttings may find growth opportunity in the sand bed media. There is currently no invasive growth in the sand bed.

Outlet Conditions

This facility is equipped with a submerged sump beneath the sand bed filter. Discharge from the sand bed collection sump is pumped mechanically to a neighboring stormwater conveyance ditch on site. There are no discharge outlet structures other than piping associated with the sump pump. No irregularities were noted with these devices.

Mosquitoes and Other Vectors

Due to impervious surfaces and persistent onsite activity, no vector problems were evident during the storm events monitored. To date, there has been no mosquito breeding concerns noted at this facility.

Structural Integrity

Due to the uneven distribution of water flow over the weir plate to the sand bed at this facility, “v” notches were cut into the weir to promote outflow opportunities along the length of the weir. This structural modification corrected the concentrated flow problem (see Section 3, Maintenance).

During the first monitored storm event at this facility on March 20 1999, it was evident that structural problems were affecting hydraulic flow-through: there was no discharge from the BMP following the first storm of its operation. The construction contractor was notified and a repair initiated. During the investigation it was found that the sump floor of the sand filter was leaking and filtered stormwater was being lost to the substrate.

2.2.3.3 Site 74203 – Sand Filter, Foothill Maintenance Station

Hydraulic Characteristics

As with the Eastern Regional Maintenance Station SF noted above, empirical observations were collected for four principal 1998/1999 storms at this facility. During each event, hydraulic flow from the sediment chamber through the weep pipe to the sand filter weir appeared consistent. However, overflow from the weir plate to the sand bed was confined to the area in front of the weep pipe discharge outlet (north end of weir plate), which resulted in a concentrated flow to the adjacent gravel rip-rap at this location. Hence, overflow to the sand bed tended to follow a naturally defined gradient toward the collection pump well. Broad and uniform flow over the sand media did not occur, but was rather limited to a narrow tributary directed toward the pump well. See Section 1.1.3 for additional details and discussion on other hydraulic characteristics.

Inlet Conditions

The inlet structure functioned properly during each monitored storm event. No problems were noted. On one occasion the water in the sediment basin backed up into the inlet invert but did not cause bypass.

Water Quality

Trash and organic material were observed entering the basin on all occasions. Storm water collected in the sedimentation basin generally was an opaque brown with heavy cloudiness. An oily surface sheen was observed during each event. No odor was detected.

Solids Deposition and Resuspension

Various non-stormwater flows at this location contribute to sediment buildup in the sediment chamber.

During stormwater inflow, inflow agitation redistributes sediment settled on the chamber floor in the vicinity of the downspout. This likely attributed to opaque coloration in the sediment chamber water.

Erosion

There are no erosion concerns at this SF facility. The entire site is paved and impervious to rainfall.

Vegetation Conditions

There are no vegetation concerns at this SF facility. The entire site is paved and provides no opportunity for significant vegetative growth. However, as this BMP ages, maverick seeds, spores, or other windblown plant cuttings may find growth opportunity in the sand bed media. There is currently no invasive growth in the sand bed.

Outlet Conditions

This facility is equipped with a submerged sump beneath the sand bed filter. Discharge from the sand bed collection sump is pumped mechanically to a neighboring stormwater conveyance ditch on site. There are no discharge outlet structures other than piping associated with the sump pump. No irregularities were noted with these devices, except for flow metering malfunctions that were inherent to electronic instrumentation. These problems have been repaired.

Mosquitoes and Other Vectors

Due to impervious surfaces and persistent onsite activity, no vector problems were evident during the storm events monitored. However, due to persistent influx of non-stormwater discharge, this facility is prone to harboring standing water and the potential for mosquito breeding. SGV VCD has identified mosquito presence in this BMP but has not treated standing water because of access limitations.

Structural Integrity

Due to the uneven distribution of water flow over the weir plate to the sand bed at this facility, “V” notches were cut into the weir to promote outflow opportunities along the length of the weir. This structural modification corrected the concentrated flow problem (see Section 3, Maintenance).

2.2.3.4 Site 74204 – Sand Filter, Termination Park and Ride

This facility was not online during the 1998/1999-storm season. No data is available for reporting.

2.2.4 Multi-chambered Treatment Trains

Brown and Caldwell will be monitoring three MCTT facilities during the 1999/2000 wet season. These include site 74104 (Metro Maintenance Station), site 74206 (Via Verde Park and Ride), and site 74208 (Lakewood Park and Ride).

2.2.4.1 Site 74104 – Multi-chambered Treatment Train, Metro Maintenance Station).

This facility was not online during the 1998/1999-storm season. No data is available for reporting.

2.2.4.2 Site 74206 – Multi-chambered Treatment Train, Via Verde Park and Ride

This facility was not online during the 1998/1999-storm season. No data is available for reporting.

2.2.4.3 Site 74208 - Multi-chambered Treatment Train, Lakewood Park and Ride

This facility was not online during the 1998/1999-storm season. No data is available for reporting.

2.3 BMP Operations Summary

Brown and Caldwell operated four BMP facilities during four storm events for the 1998/1999 monitoring season:

1. I-5/I-605 Extended Detention Basin (Site 74101),
2. I-605/SR-95 Extended Detention Basin (Site 74102),
3. Eastern Regional Maintenance Station Sand Filter (Site 74202), and
4. Foothill Maintenance Station Sand Filter (Site 74203).

In general, all BMPs performed as designed, although minor design modifications have been necessary. Design features that have required minor modifications during this first monitoring year include:

1. I-5/I-605 Extended Detention Basin (Site 74101)
   a. Reconfigure discharge outlet flow monitoring configuration
      i. Remove V-notch weir to promote thorough drainage and reduce standing water
      ii. Install H-flume for high-accuracy, low-flow discharge monitoring

   b. Improve site drainage conveyance to reduce onsite ponding outside of BMP

2. I-605/SR-91 Extended Detention Basin (Site 74102)
   a. Increase residence time by modifying discharge weep pipe

3. Eastern Regional Maintenance Station Sand Filter (Site 74202)
   a. Repair leakage from sand filter sump
   b. Modify sand filter weir plate to promote improved distribution of stormwater flow over the sand filter bed
   c. Modify electronic flow instrumentation to improve flow monitoring accuracy

4. Foothill Maintenance Station Sand Filter (Site 74203)
   a. Modify sand filter weir plate to promote improved distribution of stormwater flow over the sand filter bed
   b. Modify electronic flow instrumentation to improve flow monitoring accuracy

As expected, each BMP that began operation this first year required some level of “fine tuning” to optimize performance.

3.0 BMP AND SITE MAINTENANCE

3.1 Introduction and Methods

The primary objective of BMP maintenance is to ensure the each site is properly maintained to achieve optimum performance. Both preventive and corrective maintenance measures that may be necessary to achieve this objective, can include:

- Removal of standing water,
- Sediment erosion, control, and removal,
- Structural integrity,
- Landscape management,
- Graffiti removal,
- Trash and debris removal,
- Mosquito and vector control, and
- General facility maintenance.

To date, maintenance has been conducted on four of the eight constructed BMPs that were operational during the wet season (I-5/I-605 and I-605/91 EDBs, and the Eastern Regional and Foothill Maintenance Station sand filters). Four additional sites are now operational and will be incorporated into the June 1999 maintenance inspections (Alameda Maintenance Station OWS, Termination Park and Ride SF, and Lakewood and Via Verde Park and Ride MCTTs).

Regularly scheduled maintenance inspections are conducted monthly, with weekly surveys being performed during extended periods of wet weather. Maintenance visits are also conducted after each large storm event (greater than 0.5 inches). During the visits, maintenance observations and needs were documented on the "BMP Site Inspection Checklist" (Form C). Based on this documentation, any immediate maintenance needs were arranged. Maintenance activities conducted between initial operation dates (beginning in February 1999) and present are summarized below.

3.2 Summary of Inspection and Maintenance Activities

Activities associated with inspection and maintenance visits conducted to date are described below in terms of each operational BMP type.

3.2.1 Extended Detection Basins

3.2.1.1 Site 74101—Extended Detention Basin, I-5/I-605

Removal of Standing Water

Following storm events, the EDBs are allowed to drain over a period of 48 to 72 hours, after which time site visits are made to check if standing water is present to control mosquito breeding. On several occasions, standing water has been observed inside the concrete discharge outlet structure that accepts flow from the associated weep pipe. Standing water has been routinely removed using a sump pump, which was allowed to discharge through the effluent pipe to promote drainage away from the basin and into the neighboring conveyance system.

Sediment Erosion, Control, and Removal

EDB slope erosion is not a particular concern at this site due to the concrete lining design, and no erosion has been noted during site visits. Basin slopes and the immediate area surrounding the BMP have been hydroseeded to control and prevent erosion.

Since beginning operation in February 1999, sediment accumulation from stormwater runoff has not been significant due to the few storm events that occurred during the 1998/1999 wet season. Accordingly, sediment removal, testing, and disposal has not been required at this site. It is anticipated that sediment will not need to be removed prior to the end of the 1999/2000 storm season. However, at any time should basin sediment accumulate to a depth of 18 inches, appropriate sediment management actions will be implemented.

Structural Integrity

As this facility is only several months old, no structural problems have been observed during the maintenance visits or stormwater monitoring events. However, there are some related structural features at this location that are being modified to improve site drainage that is not associated with BMP operation. The following structural modifications are expected during the summer of 1999:

- The discharge outlet will be modified to include an H-flume to improve flow monitoring capabilities during low flow, while promoting complete drainage of the BMP
- The drainage gradient to the nearby stormwater conveyance system will be improved to eliminate onsite ponding.
- The drainage channel that bisects this site will be improved to reduce ponding and allow vehicle crossings along a newly constructed gravel driveway exit to the east.

Landscape Management

Vegetation has established well along the outside slopes of the basin. The hydroseed applied in February 1999 took several months to establish, and has grown to completely cover this site with grass and wildflowers. Weeds are also present.

In accordance with the revised vegetation guidelines specified in the Maintenance Indicator Document (MID), vegetation is allowed to grow to approximately 18 inches before cutting to a 12-inch maintenance height. On May 28, 1999, the contracted landscape-management company prepared the site for vegetation management (scheduled for June 8, 1999). All vegetation management work is being limited to using string trimmers so the basin slopes are not damaged from lawn mower wheel ruts. All cuttings along the inside basin sidewalls (down to the where the concrete lining starts) will be removed from the site and properly disposed. In addition to cutting the grass, the landscaping contractor will remove any weeds that threaten the growth of the desired vegetation.

Graffiti Removal

To date graffiti at this site has not been an issue. If graffiti is encountered at this site, the graffiti will be removed to maintain the appearance of the facility.

Trash and Debris Removal

Accumulated trash near the influent rip-rap has been removed during each maintenance inspection. Routing trash accumulation around the influent structure has been mostly floatable materials such as cigarette butts, plastic cups, paper, and styrofoam debris.

Mosquito and Vector Control

The Greater Los Angeles County Vector Control District (GLACVCD) has been conducting vector control inspections at this basin. To date, there have been no mosquito or vector treatments necessary at this location. Mosquito egg rafts have been observed at this BMP, but standing water management has precluded the need for chemical treatment. No other vector problems have been noted at this site.

General Facility Maintenance

General facility maintenance that has occurred to date at this EDB location included aesthetics management and improvements to minimize vandalism. Since this site is located along an interstate freeway and there is no perimeter security fencing, it is accessible to the public. Therefore, extra precautions are appropriate to prevent equipment theft and vandalism. The installation of a driveway gate is being arranged to limit unwanted vehicle access to the site. Steel, low-profile equipment enclosures are maintained at this site to help to secure instrumentation.

3.2.1.2 Site 74102: Extended Detention Basin, I-605/SR-91

Removal of Standing Water

To date, there has been no standing water observed at this earthen basin facility following storm events. However, this is particularly due to the short residence times observed at this EDB. Storm water tends to flow through the basin with very little detention. This is apparent by the short amount of time is takes for the basin to drain following the abatement of rain. Based on the storm events that have occurred this year, the basin appears to be retaining the water for less than 24 hours. The design engineer is being consulted on ways to improve the detention time of this basin.

Sediment Erosion, Control, and Removal

Due to the young age of this EDB, no erosion of the basin slopes by stormwater runoff has been observed. Hydroseeded vegetation has established well throughout this site. However, on May 28, 1999, it was noted that contractors who also occupy a portion of the site are impacting the stability of this earth EDB. The BMP is being used as a staging area for light standards and other equipment. The outer basin slopes have been used as a staging area, and construction debris has been noted in several areas in and near the basin. Caltrans has been notified of this problem and is in the process of correcting the problem. Continued misuse of the basin by construction contractors could result in soil erosion and slope stability problems within this basin.

Since this EDB only became operational in February 1999, very little sediment has accumulated as a result of stormwater runoff. Therefore, sediment removal, characterization, and disposal have not been necessary at this site. It is anticipated that sediment will not need to be removed prior to the end of the 1999/2000 storm season. Once 18 inches of sediment has accumulated, arrangements will be made for sediment removal and disposal.

Structural Integrity

Other than impacts associated with independent contractors driving in and around this BMP, there are no structural issues that have required maintenance, which are associated with stormwater monitoring.

Landscape Management

Vegetation has established well in the basin and basin slopes. The vegetation was put in place using a hydroseed mixture in February 1999. Although the hydroseed took several months to get established, the site is currently completely covered.

In accordance with newly proposed maintenance threshold guidelines, grass and weeds will be allowed to grow to approximately 18-inches prior to being cut. On May 28, 1999, a landscaping contractor was onsite to prepare for maintaining vegetation back to 12 inches. Only string trimmers will be used to maintain vegetation so the basin slopes are not damaged from lawn mower wheel ruts. All cuttings from inside basin will be removed from the site and properly disposed. Cuttings on outside slopes will remain in place as thatch to further control erosion potential. Weeds that threaten the growth of the desired vegetation will be removed. The work is currently scheduled for June 8, 1999.

Graffiti Removal

To date graffiti at this site has not been an issue at this facility. However, this site has a strong potential for vandalism. Other contractors utilizing this right-of-way have had significant theft activity. This site may require above average maintenance to correct for theft and graffiti damage.

Trash and Debris Removal

During storms, trash has routinely been observed collecting in and around the rip-rap at the inlet structure. Trash that has been encountered includes cigarette butts, plastic cups, respirator masks, aluminum cans, paper, and styrofoam. Trash and debris were removed during each site visit.

Mosquito and Vector Control

GLACVCD has been conducting vector control inspections at this site. No vector issues have been noted at this site by the GLACVCD. However, Brown and Caldwell has noted the presence of gopher holes along the basin slopes. Remedial action to control burrowing animals is currently being proposed. It is expected that corrective action will occur once a biological assessment has been made regarding threatened, endangered, or protected species has been made.

General Facility Maintenance

General facility maintenance conducted to date has mostly included aesthetic management and security control. This site is enclosed with a fence to limit public access. However, non-BMP contractor activity at this site continues to affect aesthetics and security. On several visits to the site, the gate has been found unlocked, off its hinges, or torn down. The security gate at this site is in need of total replacement. Although the fence is not associated with the detention basin construction or operation, Caltrans has been notified of the situation so that the right-of-way security fence may be repaired.

During each visit, all locks are checked to make sure that they are secure and working and all equipment is checked to make sure that it is present and has not been damaged by vandalism.

3.2.2 Sand Filter Type I

The following discussion summarizes maintenance activities at sand filter BMPs that operated during the 1998/1999 wet season.

3.2.2.1 Site 74202: Sand Filter, Eastern Regional Maintenance Station

Removal of Standing Water

Standing water has occurred at this sand filter site. Currently standing water accumulates in the weir and the sand filter chamber sump. Water from the sump and sediment chamber was removed by running the sump pump and discharging the water to the storm drain associated with the sand filter. Water within the weir is allowed to remain until it evaporates.

To prevent the standing water from becoming a vector control issue with respect to mosquitoes, standing water is treated by the Greater Los Angles County Vector Control District (GLACVCD) during their weekly site visits. The water is treated by placing briquettes, which float in the water and prevent the hatching of mosquito larvae. Screening has been applied to the sump well structure to limit vector access and is expected to reduce GLACVCD treatment needs.

Sediment Control and Removal

Since this site only became operational in February of 1999, sediment accumulation within the sediment chamber has not been that significant. Currently there is approximately 0.25 to 0.5 inches of sediment that has accumulated along the sediment chamber floor. It is anticipated that sediment will be removed from the sediment chamber following the 1999/2000-storm season, unless the sediment begins to clog the orifices of the perforated riser or fills 25% of the storage volume.

The accumulation of sediment on the sand filter has not been significant this year. Sediment will be removed from the sand filter when sediment appears to be clogging or impairing the performance of the filter bed.

Structural Integrity

Leakage from the sand filter sump of this BMP has been a water-containment integrity issue. The construction contractor was notified of the problem and has made one attempt to repair a leak in the sump. The repair was successful only in slowing the leak but did not completely seal the sump. The contractor has scheduled further repairs to begin approximately June 3, 1999.

There are no other structural integrity issues at this site. No problems were noted during the maintenance visits or stormwater observation visits.

Landscape Management

No landscaping is present at this site, and landscape management is not required. However, if weeds are noted at this site they will be removed during maintenance visits to keep the site aesthetically pleasing.

Graffiti Removal

To date graffiti at this site has not been an issue. If graffiti is encountered at this site, the graffiti will be removed to improve the appearance of the facility.

Trash and Debris Removal

Minor amounts of trash associated with stormwater runoff have been noted at this site within the sediment chamber. Trash that has been observed includes plastic cups and styrofoam. Trash and debris are removed during each site visit.

Mosquito and Vector Control

GLACVCD also conducts vector control inspections at this site. No vector issues have been present at this site. However, measures have been taken to prevent problems. Mosquito netting has been placed over the sump area to prevent mosquitoes from breeding in standing water. In addition, netting has also been installed over the air vents associated with each sampling shed to prevent bees from building hives in the sheds.

General Facility Maintenance

Other general facility maintenance has been minimal at this facility, and has mostly involved aesthetic management. This site is enclosed with a fence and is located on an active maintenance facility so it is not readily accessible to the public. During each visit, all locks are checked to make sure that they are secure and working and all equipment is checked for damage or vandalism. All fences and gates are inspected to make sure that they are working properly and are not damaged in any way.

3.2.2.2 Site 74203: Sand Filter, Foothill Maintenance Station

Removal of Standing Water

Standing water continues to be a maintenance management issue at this site. Currently non-stormwater discharges are contributing to increased maintenance needs at this BMP in terms of managing standing water. Non-stormwater accumulates in the sediment chamber and in the weir and sump area within the sand filter chamber. As the sand filter sump accumulates filtered water, it is removed by running the sump pump and discharging the water to the storm drain associated with the sand filter. Water within the sediment chamber and the weir is allowed to remain until it evaporates, and is treated with vector control chemicals if it persists.

To prevent the standing water from becoming a vector control issue with respect to mosquitoes, standing water will be treated by the San Gabriel Vector Control District (SGVCD) during their weekly site visits.

Sediment Control and Removal

Since this site only became operational in February of 1999, sediment accumulation within the sediment chamber from stormwater inflow has not been that significant. Currently there is approximately 0.5 inches of sediment that has accumulated along the sediment chamber floor. However, it is believed that most of this accumulation is attributed to non-storm flow. Non-stormwater flow at this site has been higher than anticipated and is contributing to sediment accumulation in the BMP. Sediment removal, characterization, and disposal are not anticipated until after the 1999/2000-storm season. However, if sediment begins to clog the orifices of the perforated riser or fills 25% of the storage volume of the sediment chamber, arrangements for the removal and disposal of the sediment will be made earlier.

The accumulation of sediment on the sand filter has not been significant this year. Sediment will be removed from the sand filter when sediment exceeds 1 to 2-inches or if sediment appears to be clogging or impairing the performance of the filter bed.

Structural Integrity

There have been no structural concerns at this BMP.

Landscape Management

No landscaping is present at this site, and landscape management is not required. However, if weeds are noted at this site they will be removed during maintenance visits to keep the site aesthetically pleasing.

Graffiti Removal

To date graffiti at this site has not been an issue. If graffiti is encountered at this site, the graffiti will be removed to improve the appearance of the facility.

Trash and Debris Removal

Minor amounts of trash in stormwater runoff have been noted within the sediment chamber of this BMP. Paper and styrofoam debris were removed during each maintenance visit.

Mosquito and Vector Control

The SGVVCD conducts vector control inspections at this site. Due to persistent inflow of non-stormwater at this maintenance station, standing water in the BMP sediment chamber has been identified as a vector concern. SGVVCD has observed mosquito activity in this BMP but will not treat the unit until safe and permanent access to allow sample collection is provided. Access by extension ladder is not suitable due to possible footing slippage on accumulated mud in the sediment chamber. Permanent ladder installations have been recommended by SGVVCD. Permanent ladders are being ordered and will be installed to provide access to the sediment chamber.

Although the automatic discharge pump of this BMP assists in reducing standing water within the sand filter area, standing water in the sediment chamber must be removed by other means. To reduce costs associated with the persistent, mechanical removal of standing water in the sediment chamber, chemical vector treatment will be the preferred method of control.

Apart from BMP activities, the SGVVCD has noted several other vector concerns at this site, which include but are not limited to bee nesting opportunities and waste pile management (rats/roaches). At the recommendation of SGVVCD, netting has been installed over the air vents of the BMP equipment enclosures to prevent bees from nesting inside. Tight-mesh netting has also been in place over the sump area to prevent mosquito entry and breeding opportunities.

General Facility Maintenance

Other general facility maintenance at this site has been minimal due to the security provided by the maintenance station, which limits public access. Planned maintenance at this site includes replacing cedar vault hatch covers with aluminum, reinforced covers that will provide additional weight-bearing capacity.

3.2.2.3 Site 74204: Sand Filter, Termination Park and Ride

This sand filter site became operational in April 1999, and no storm monitoring or maintenance visits were conducted at this site during the 1998/1999 storm season. This site will be incorporated into the June 1999 maintenance visits cycle.

Maintenance issues that are expected at this site are similar to issues that are present at the other sand filter sites. These issues include standing water, vector control, and sediment accumulation and removal. As applicable, these issues will be addressed in a similar manner as they are at the sand filters. In addition, this site is located in a large and busy public parking facility that will require additional attention to ensure that site does not become a target for vandalism or graffiti.

One maintenance issue that has already been noted at this site includes breeding of mosquitoes. This was noted by the GLACVCD on a site visit conducted during the week of May 21, 1999. Because of vector concerns to a neighboring elementary school, Golden Bear oil was applied to the accumulated water in the sediment chamber to inhibit hatching. Preventative measures are currently being taken to prevent further breeding of the mosquitoes by installing mosquito netting over the sump and removing any standing water present at the site.

3.2.3 Multi-Chambered Treatment Trains

3.2.3.1 Site 74206: Multi-Chambered Treatment Train, Via Verde Park and Ride

The multi-chambered treatment train (MCTT) located at the Via Verde Park and Ride became operational in May 1999. Since this MCTT only became operational a month ago, no storm or maintenance inspections have been conducted. This site will be incorporated into the June 1999 maintenance visits.

Maintenance issues that are expected at this site include standing water in the various chambers, vector control, vandalism and graffiti, and general site maintenance.

3.2.3.2 Site 74208: Multi-Chambered Treatment Train, Lakewood Park and Ride

The multi-chambered treatment train (MCTT) located at the Lakewood Park and Ride became operational in May 1999, and has not undergone storm monitoring or maintenance inspections. This site will be incorporated into the June 1999 maintenance visits.

Maintenance issues that are expected at this site include standing water in the various chambers, vector control, vandalism and graffiti, and general site maintenance.

Mosquito breeding has also been noted at this facility by GLACVCD during a site visit conducted during the week of May 21, 1999. GLACVCD treated the standing water with Vectolex. Mosquito netting over the sump area has been installed as a preventative measure to mitigate mosquito entry and breeding in the sump. As it is encountered during site inspections and maintenance visits, standing water is removed to limit breeding opportunities.

3.2.4 Oil/Water Separator

3.2.4.1 Site 74201: Oil/Water Separator, Alameda Maintenance Station

The oil/water separator located at the Alameda Maintenance Station became operational in May 1999, and has not been subject to stormwater monitoring nor has it required maintenance attention. This site will be incorporated into the June 1999 maintenance visits.

Maintenance issues that are expected at this site include sediment removal and disposal, trash removal and disposal, oil/grease removal, cleaning, and general maintenance.

4.0 DESIGN AND CONSTRUCTION EVALUATION

The following discussion paraphrases design and construction activities at each BMP that was constructed site during the 1998/1999 monitoring season.

4.1 Alameda Maintenance Station

Construction activities were substantially completed at the Alameda Maintenance Station site in early April. Brown and Caldwell staff and Caltrans representatives inspected the site on April 19, 1999. Following this inspection, a short punch list was created that listed additional tasks required to deem construction complete and to close the Caltrans construction encroachment permit. These final tasks were completed in early May 1999. Mr. Tyrone Taylor (Caltrans Permit Inspector) has verbally concurred that the site was complete and is in the process of submitting paperwork to that affect.

During the installation of the oil / water separator, minor changes were made in order to accommodate field conditions. The final location of the oil / water separator tank was shifted several feet from the originally planned location to avoid sub-surface utilities. Grades and elevations were slightly modified in the field to ensure that the system would drain properly. Additional fencing was installed along the west side of the BMP at the request of the Maintenance Station Superintendent to improve access to the east side of the building. With the exception of these few items, the oil / water separator system was installed in accordance with the design plans. Operational parameters such as capture volume and drainage area remain unchanged by these minor modifications.

4.2 Eastern Regional Maintenance Station

By late February 1999, Eastern Regional Maintenance Station construction activities were mostly complete. Following inspection of the site by Brown and Caldwell and Caltrans staff (March 9, 1999), additional tasks required to close the Caltrans construction encroachment permit were identified. These tasks were completed in early May. A Caltrans Permit Inspector (Andy Bott) later concurred that the site was complete on May 17, 1999, and submitted paperwork officially closing the construction encroachment permit for this site.

Minor installation changes to the media filter were made to accommodate field conditions, which included shifting the BMP location from its original planned location. At the request of the Maintenance Station Superintendent, the BMP location was shifted in order to allow access to the facility's southeast entrance. Grades and elevations also were slightly modified in the field to match the existing site grades. With the exception of these few items, the media filter was installed in accordance with the design plans. Operational parameters (capture volume and drainage area) were not changed by the BMP re-location.

During the March 25th storm event concerns were raised over the integrity of the sump at the Eastern Regional Site. Effluent failed to accumulate in the sand filter sump, and no samples could be collected. Significant leaking of the sand filter sump was found to be the problem, which allowed treated water to be released to the substrate underneath. The construction contractor was notified and a silicone-based sealant was applied to the seams of the sump. However, during the April 6th sampling event, field personnel observed that the water level in the effluent sump was dropping at the Eastern Regional BMP. On April 9th field testing confirmed the effluent sump at this site was leaking. Additional tests performed after the sealant had dried revealed that although the sealant had slowed the leak, the sump was not sealed completely. The construction contractor has planned to remobilize during early June to pressure-grout the effluent sump at the Eastern Regional BMP.

4.3 Foothill Regional Maintenance Station

The Foothill Regional Maintenance Station sand filter was mostly constructed by late February 1999. On March 9, 1999, the BMP was inspected by Brown and Caldwell and Caltrans staff during which Caltrans maintenance station personnel requested minor changes to the BMP. Requested BMP changes were included with standard punch list items, which were submitted as a contractor change order. Following inspection by a Caltrans Permit Inspector (Andy Bott), the requested changes were deemed complete in early May and BMP construction paperwork was filed which officially closed the construction encroachment permit for this site.

As with other BMP sites, minor installation modifications for the media filter were necessary to accommodate field conditions, which included:

- slightly modifying design grades and elevations to match the existing features,
- installing a sliding gate in the BMP fence to provide additional storage space for maintenance station operations, and
- changing the pre-cast flow interceptor box to include a traffic-rated cover and sloping the sides to accommodate truck traffic.

With the exception of these items, the media filter was installed in accordance with the design plans. Operational parameters were not affected by these modifications.

4.4 Termination Park and Ride

Construction of the Termination Park and Ride sand filter was substantially complete by early April 1999. On April 19, 1999, Brown and Caldwell and Caltrans representatives inspected the site and developed construction-completion tasks that were required to close the Caltrans construction encroachment permit. These tasks were completed in early May. On May 17, 1999, Mr. Andy Bott (Caltrans Permit Inspector) concurred that the site was complete and submitted paperwork officially closing the construction encroachment permit for this site.

Minor design changes of the media filter during installation included shifting the locations of the pre-cast concrete vaults to avoid a stormwater pipe that was closer to the BMP than shown on as-built plans, and modifying design grades and elevations to match actual conditions. With the exception of these few items, the media filter was installed in accordance with the design plans. Operational parameters were unchanged by these minor modifications.

4.5 Via Verde Park and Ride

Construction activities were substantially completed at the Via Verde Park and Ride site in early April. The BMP was inspected on April 19, 1999 by Brown and Caldwell and Caltrans staff. Punch list items required to close the Caltrans construction encroachment permit were completed, with the exception of replanting a planter area. The planter in question will be re-planted shortly, officially closing the construction encroachment permit for this site.

Prior to the construction of the MCTT, the structure was relocated about 10 feet east to allow the continued use of electric vehicle charging stations that had recently been installed at the site. This change did not affect the drainage area received by the MCTT. However, the relocation required slight changes to the outside dimensions of the structure, as well as relocations of the associated pre-cast concrete vaults. These changes did not affect the storage capacity or operation of the MCTT. Significant boulders (up to 5 feet across) were encountered during the excavation. These were not identified in the soils investigation, and added to the time expended at the site. With the exception of these changes, the media filter was installed in accordance with the design plans. Operational parameters such as capture volume and drainage area remain unchanged by these modifications.

4.6 Lakewood Park and Ride

Construction activities were substantially completed at the Lakewood Park and Ride site in early May. On May 11, 1999 Brown and Caldwell personnel met with Caltrans representatives to inspect the site. At this time the Caltrans Permit Inspector, Mr. Andy Bott, requested that a change be made in the BMP fence to accommodate traffic flow. This change was included on the punch list and is currently being negotiated as a change order. Following the resolution of this change, paperwork officially closing the construction encroachment permit for this site can be filed.

During the installation of the MCTT, minor changes were made in order to accommodate field conditions. The locations of the pre-cast concrete vaults were shifted slightly from the originally planned location. This was necessary in order to avoid a stormwater pipe that was closer to the pre-cast vaults than was shown on as-built plans. Grades and elevations also were slightly modified in the field to match the existing site grades. With the exception of these few items, the media filter was installed in accordance with the design plans. Operational parameters such as capture volume and drainage area remain unchanged by these minor modifications.

FIRST YEAR 1998-1999 REPORT

CTSW-RT-99-083

**Caltrans BMP Retrofit
Pilot Program**

CALIFORNIA DEPARTMENT OF TRANSPORTATION

*DISTRICT 7
LOS ANGELES*

PREPARED BY:

LAW Crandall
LAWGIBB Group Member

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1.0 STORMWATER DATA

1.1 Objective

One objective of the Caltrans Best Management Practice (BMP) Pilot Program is to evaluate the performance of Drain Inlet Inserts (DIIs). A comprehensive water quality monitoring study has been designed to meet these objectives by evaluating the DII's performance in the removal of contaminants from stormwater runoff and by understanding the level of effort required to maintain the DIIs at optimal effectiveness. Data collected from the 1998/99 wet season is contained in this report and is used to initially evaluate the BMP's performance. Data includes:

- Rainfall data from storm events during the study period (Section 1.1);
- Water quality and quantity of runoff discharged from the DIIs (Sections 1.1 and 1.2);
- Quality and quantity of material collected by the DIIs (Sections 1.3);
- Empirical observations of water quality, traffic, rainfall, and antecedent conditions (Section 2.0); and
- Documentation records of inspection and maintenance activities performed (Section 3.0).

In addition to data collected at DII sites, baseline soil sampling of the Infiltration Basin (073101) was performed (refer to Section 1.6). The Infiltration Basin is located at the I-605/SR-91 interchange. Because the Infiltration Basin was deemed operational late in the 1998/99 wet season, no additional monitoring data, inspection or maintenance information has been collected.

1.2 BMP Description

1.2.1 Drain Inlet Inserts

Two types of DIIs were evaluated during the 1998/99 wet season. The first type is the StreamGuard™ DII, manufactured by Foss Environmental Services; the second type is the Fossil Filter™ DII, manufactured by KriStar Enterprises, Inc. with cartridges containing absorbent material.

The Fossil Filter™ DII (Photograph 2-1) is designed to remove oil, grease, and sediment from stormwater discharges. The Fossil Filter™ DII consists of a rectangular tray with four cartridges containing adsorbent material that sits in a drain inlet. As stormwater runoff flows through the insert, oil and grease are adsorbed to adsorbent granules and sediment is captured on top of and inside the cartridges (Photograph 2-2). The Fossil Filter™ DII is designed to not impede hydraulic flows by allowing flow to bypass the cartridges and discharge through the center of the DII.

The StreamGuard™ DII (Photograph 2-7) is designed to remove oil, grease, and sediment from stormwater discharges. As stormwater runoff flows through the insert, the geotextile fabric absorbs oil and retains sediment. This insert is also designed to collect sediment in the conical-shaped portion of the unit. Floating oil and grease are absorbed by a polymer absorbent contained in a screen bag fixed within the unit (Photograph 2-8). Based on manufacturer's literature, a newly installed StreamGuard™ DII is capable of handling flows up to 1.1 cubic feet per second by water passing through the permeable geotextile fabric and by bypassing water through two openings in the geotextile fabric. The overflow rate through the two openings is approximately 0.6 cubic feet per second.

To gain an understanding of the service life of each DII and to determine how constituent removal are affected by the DIIs age and use, DIIs were replaced at different rainfall intervals based on cumulative rainfall measured. Table 1-1 describes the installed location of each DII and its replacement interval.

Table 1-1
Drain Inlet Location and DII Replacement Interval

Location	DII Type	DII Replacement Interval
Foothill Maintenance Station (073216) north inlet	StreamGuard™	0.5-inch cumulative precipitation
Foothill Maintenance Station (073216) south inlet	Fossil Filter™	
Las Flores Maintenance Station (073217) north inlet	StreamGuard™	4.0-inches cumulative precipitation
Las Flores Maintenance Station (073217) south inlet	Fossil Filter™	
Rosemead Maintenance Station (073218) north inlet	Fossil Filter™	Cumulative precipitation during an annual storm season or when replacement is needed in accordance with the manufacturer's recommendations, whichever occurs first.
Rosemead Maintenance Station (073218) south inlet	StreamGuard™	

1.2.2 Infiltration Basin

An infiltration basin (IB) is a depression used to detain stormwater for short periods until it percolates into the groundwater table or dissipates through evapotranspiration. An IB functions by infiltrating runoff and adsorbing pollutants using site vegetation and soils.

1.3 Hydrology

Rainfall quantity is a key factor used to evaluate the DIIs' performance. Anticipated rainfall quantity was also used in part to make stormwater monitoring mobilization decisions. Precipitation was measured both by onsite "tipping-bucket"-type rain gauges and by the nearest California Department of Forestry weather stations. Following is a summary of the California Department of Forestry weather stations used for the DII sites.

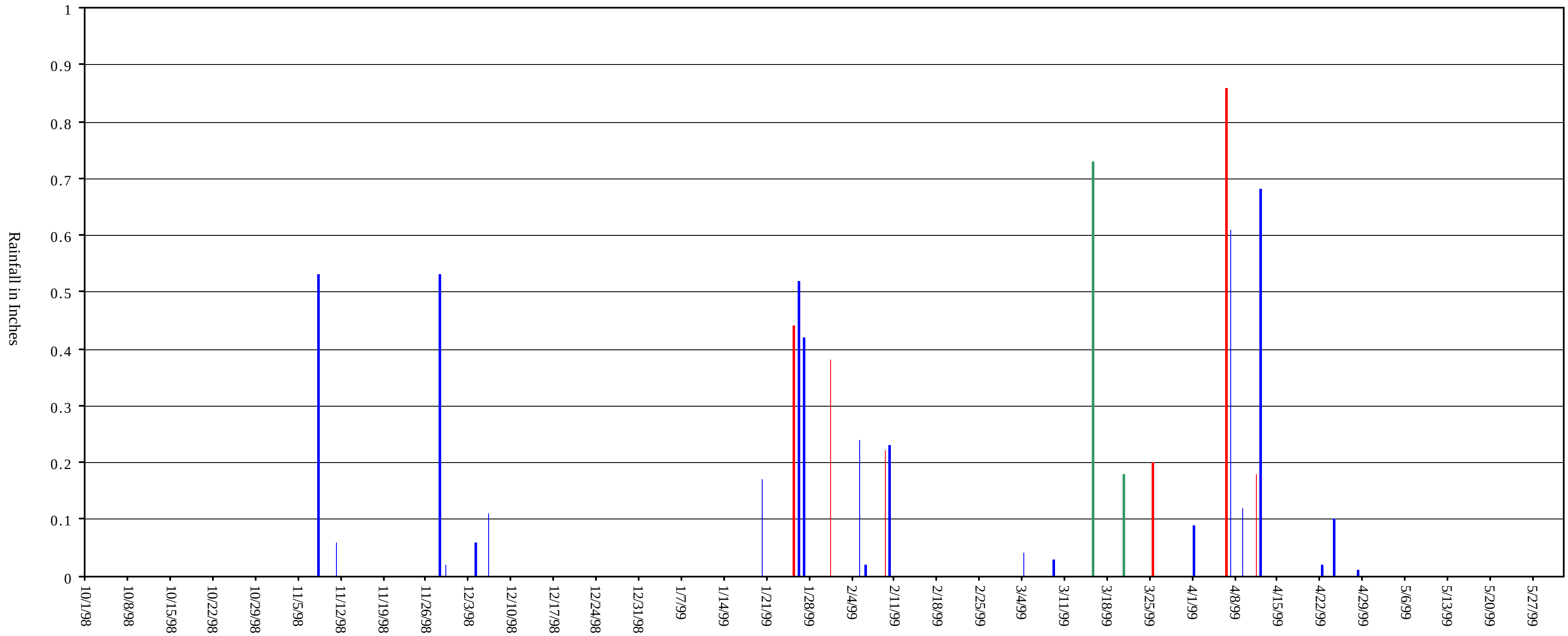
Station: Santa Fe (SAF)
County: Los Angeles
Nearest BMP Site: Foothill and Rosemead Maintenance Stations
Latitude: N 34.1210°
Longitude: W 117.9460°
Elevation: 500 ft
River Basin: San Gabriel River
Data Collection: Satellite

Station: Malibu (MLB)
County: Los Angeles
Nearest BMP Site: Las Flores Maintenance Station
Latitude: N 34.0580°
Longitude: W 118.6330°
Elevation: 1,575 ft
River Basin: Ventura LA Coastal
Data Collection: Satellite

1.3.1 Precipitation During the 1998/1999 Water Year (Indicator Sites and BMPs)

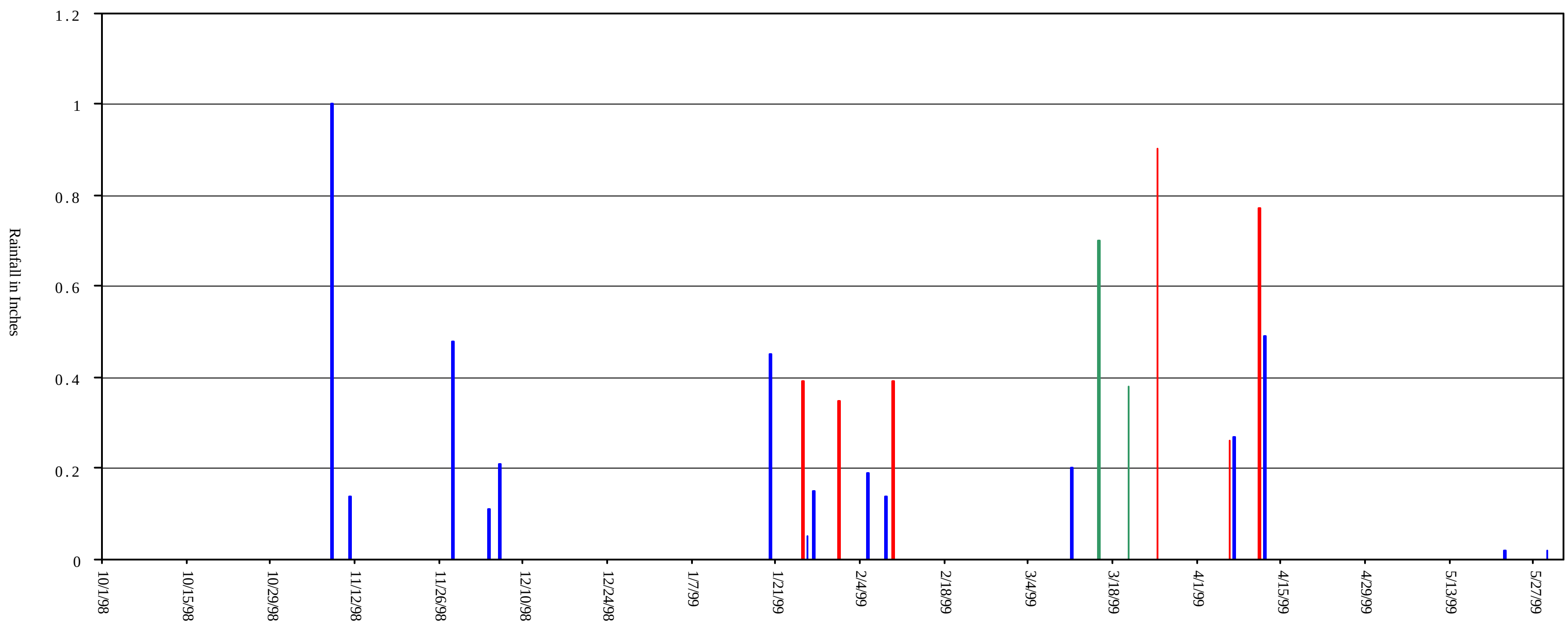
Based on the Operation, Maintenance and Monitoring (OMM) Plan, the water year (i.e., wet season) has been defined as the period between October 1 and May 30. Figure 1-1 graphically presents daily precipitation totals for the Foothill and Rosemead Maintenance Stations; Figure 1-2 graphically presents daily precipitation totals for the Las Flores Maintenance Station. Daily rainfall totals were obtained from California Department of Forestry weather stations.

Figure 1-1
Daily Precipitation Totals for Foothill and Rosemead Maintenance Stations (1)



(1) Totals obtained from the California Department of Forestry Santa Fe (SAF) weather station. Daily totals are based on the period from 5:00 p.m. to 5:00 of the preceding day. Red lines indicate events for which both samples and empirical observations were taken.
Green lines indicate events for which only empirical observations were taken.
Blue lines indicate events for which neither samples nor empirical observations were taken.

Figure 1-2
Daily Precipitation Totals for Las Flores Maintenance Station(1)

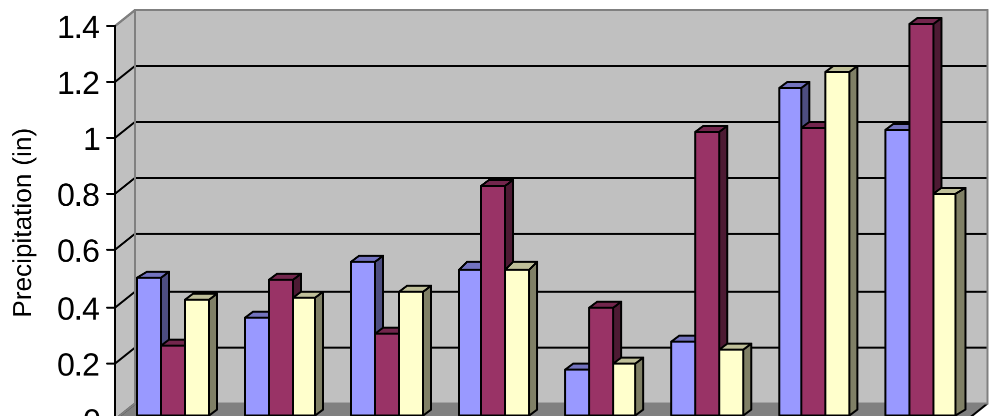


(1) Totals obtained from the California Department of Forestry Malibu (MLB) weather station. Daily totals are based on the period from 5:00 p.m. to 5:00 p.m. of the preceding day.
Red lines indicate events for which both samples and empirical observations were taken.
Green lines indicate events for which only empirical observations were taken.
Blue lines indicate events for which neither samples nor empirical observations were taken.

1.3.2 Precipitation During Monitored Events

As presented in Figures 1-2 and 1-3, samples and/or empirical observations were taken during eight events. Storm precipitation totals for monitored events at the DII locations were measured onsite by "tipping-bucket"-type rain gauges. Figure 1-3 graphically presents monitored event totals at Foothill, Las Flores, and Rosemead Maintenance Stations.

Figure 1-3
Monitored Events Precipitation Totals



	1/25/99	1/31/99	2/9/99	3/15/99	3/19/99	3/25/99	4/6/99	4/11/99
Foothill Maintenance Station	0.49	0.35	0.54	0.52	0.16	0.26	1.16	1.01
Las Flores Maintenance Station	0.25	0.48	0.29	0.81	0.38	1.00	1.02	1.39
Rosemead Maintenance Station	0.41	0.42	0.44	0.52	0.18	0.23	1.22	0.78

1.3.3 Storm Water Runoff During Monitored Events

Flow rates of stormwater runoff discharging through the DIIs were measured using American Sigma 950 bubblers in conjunction with Palmer-Bowlus Flumes. Table 1-2 summarizes hydrologic and hydraulic characteristics of each sampling event at the DII locations.

Table 1-2
Hydrologic and Hydraulic Characteristics of Sampled Events

Location	DII Type	Date	Maximum Rainfall Intensity (in/hr)	Peak Runoff Flow (ft^3/s)	Total Runoff (ft^3)
Foothill Maintenance Station	StreamGuard™	1/25/99	0.10	0.1	2,764
		3/25/99	0.10	0.1	1,088
		4/6/99	0.31	0.3	6,735
		4/11/99	0.14	0.4	5,331
Foothill Maintenance Station	Fossil Filter™	1/25/99	0.10	0.2	2,845
		3/25/99	0.10	0.3	1,020
		4/6/99	0.31	0.6	4,350
		4/11/99	0.14	0.6	8,110
Las Flores Maintenance Station	StreamGuard™	1/25/99	0.08	0.3	515
		1/31/99	0.20	0.3	374
		3/25/99	0.27	0.6	2,513
		4/6/99	0.20	0.4	1,236
		4/11/99	0.35	0.6	1,057
Las Flores Maintenance Station	Fossil Filter™	1/25/99	0.08	0.1	740
		1/31/99	0.20	1.4	949
		2/9/99	0.06	0.2	328
		3/25/99	0.27	0.5	1,671
		4/11/99	0.35	0.3	1,600
Rosemead Maintenance Station	StreamGuard™	1/31/99	0.23	0.6	1,680
		2/9/99	0.13	0.9	2,387
		3/25/99	0.11	0.2	888
		4/6/99	0.20	1.2	7,789
		4/11/99	0.10	0.4	5,513
Rosemead Maintenance Station	Fossil Filter™	1/31/99	0.23	0.1	478
		2/9/99	0.13	0.2	314
		3/25/99	0.11	0.1	172
		4/6/99	0.20	0.2	8,079
		4/11/99	0.10	0.1	1,285

1.4 Water Quality Results

Flow-weighted composite samples were collected from DII effluent using American Sigma 900 Max samplers in conjunction with American Sigma 950 bubblers and Palmer-Bowlus flumes. Sampler suction lines consisted of 3/8-inch Teflon® tubing with low-flow stainless-steel intake strainers. Sample aliquots were collected throughout the duration of each event and were transported to Montgomery Watson Laboratories for analysis. Laboratory results was evaluated and results of the Quality Assurance/Quality Control (QA/QC) analysis are summarized in

Section 1.4.1. Trace metal and hardness effluent sample results are discussed in Section 1.4.2 and conventional and other constituent effluent sample results are discussed in Section 1.4.3.

1.4.1 Assessment of Quality Assurance/Quality Control Results

Analytical data for the 1998/99 wet season was evaluated in accordance with the *National Functional Guidelines for Organic Data Review (EPA/540/R/94/090)* and *Guidance on the Documentation and Evaluation of Trace Metals Data Collected for the Clean Water Act Compliance Monitoring (EPA/821/B/95/002).* Analytical data was within acceptable QA/QC ranges except for those listed below.

- Matrix spike recovery was less than the lower limit recovery goal for the following:
  - Dissolved zinc for a sample collected from the StreamGuard™ DII at Las Flores Maintenance Station on 31 January 1999. Consequently, a "J" qualifier has been applied to the result.
  - Dissolved zinc for a sample collected from the Fossil Filter™ DII at Las Flores Maintenance Station on 31 January 1999. Consequently, a "J" qualifier has been applied to the result.
  - Dissolved zinc for a sample collected from the Fossil Filter™ DII at Rosemead Maintenance Station on 31 January 1999. Consequently, a "J" qualifier has been applied to the result.
  - Dissolved zinc for a sample collected from the StreamGuard™ DII at Rosemead Maintenance Station on 31 January 1999. Consequently, a "J" qualifier has been applied to the result.
- Matrix spike recovery was greater than the upper limit recovery goal for the following:
  - Dissolved zinc for a sample collected from the StreamGuard™ DII at Rosemead Maintenance Station on 9 February 1999. Consequently, a "J" qualifier has been applied to the result.

  The RPD (53%) for a total lead MS/MSD sample collected from the Fossil Filter™ DII at Rosemead Maintenance Station on 6 April 1999 was outside of the acceptable range (70%-130%). Consequently, a "J" qualifier has been applied to the result.
- The laboratory was unable to meet the zinc reporting limit of 1 µg/L for a sample collected from the Fossil Filter™ DII at Las Flores Maintenance Station on 9 February 1999.
- The laboratory was unable to meet the hardness reporting limit of 2 mg/L for a sample collected from the StreamGuard™ DII at Foothill Maintenance Station on 12 April 1999.

1.4.2 Trace Metals and Hardness

Trace metals (total and dissolved copper, lead, and zinc) and hardness data are presented in Table 1-3. In an aquatic environment, toxicity of these metals is inversely related to hardness. It has been postulated that soft water (generally less than 75 mg/L $CaCO_3$) can cause trace metals to become toxic.

Table 1-3
Trace Metals and Hardness Data from Effluent Samples

Sample Date	BMP Location	Site ID	BMP Type	Sampling Location	% Storm Capture	Hardness (mg/L)	Total (mg/L)			Dissolved (mg/L)		
							Cu	Pb	Zn	Cu	Pb	Zn
January 25, 1999	Foothill Maintenance Station	073216	StreamGuard™	Effluent	58	13	17	12	140	9.8	0.93	95
January 25, 1999	Foothill Maintenance Station	073216	Fossil Filter™	Effluent	93	20	17	17	160	10	1.2	87
January 25, 1999	Las Flores Maintenance Station	073217	StreamGuard™	Effluent	50	40	29	4.9	120	22	<0.50	83
January 25, 1999	Las Flores Maintenance Station	073217	Fossil Filter™	Effluent	16	27	11	6.6	220	4.8	0.50	78
January 31, 1999	Las Flores Maintenance Station	073217	StreamGuard™	Effluent	99	60	30	15	130	10	<0.50	30J
January 31, 1999	Las Flores Maintenance Station	073217	Fossil Filter™	Effluent	99	36	12	4.9	140	7.2	<0.50	85J
January 31, 1999	Rosemead Maintenance Station	073218	StreamGuard™	Effluent	99	16	15	25	150	6.6	1.2	79J
January 31, 1999	Rosemead Maintenance Station	073218	Fossil Filter™	Effluent	89	15	15	16	180	6.8	1.5	110J

Table 1-3 (Concluded)
Trace Metals and Hardness Data from Effluent Samples

Sample Date	BMP Location	Site ID	BMP Type	Sampling Location	% Storm Capture	Hardness (mg/L)	Total (mg/L)			Dissolved (mg/L)		
							Cu	Pb	Zn	Cu	Pb	Zn
February 9, 1999	Las Flores Maintenance Station	073217	Fossil Filter™	Effluent	99	58	11	7	87	5.1	<0.50	<5.0
February 9, 1999	Rosemead Maintenance Station	073218	StreamGuard™	Effluent	99	35	20	36	165	8.5	0.97	59J
February 9, 1999	Rosemead Maintenance Station	073218	Fossil Filter™	Effluent	35	51	59	110	820	4.2	0.72	41
March 25, 1999	Foothill Maintenance Station	073216	StreamGuard™	Effluent	81	11	8.3	2.6	96	6.9	0.50	87
March 25, 1999	Foothill Maintenance Station	073216	Fossil Filter™	Effluent	79	33	20	16.0	160	12	0.68	86
March 25, 1999	Las Flores Maintenance Station	073217	StreamGuard™	Effluent	32	38	18	4.8	49	12	<0.50	21
March 25, 1999	Las Flores Maintenance Station	073217	Fossil Filter™	Effluent	83	20	12	7.0	93	4	<0.50	26
March 25, 1999	Rosemead Maintenance Station	073218	StreamGuard™	Effluent	99	29	32	50	280	18	2.2	120

Table 1-3 (Concluded)
Trace Metals and Hardness Data from Effluent Samples

Sample Date	BMP Location	Site ID	BMP Type	Sampling Location	% Storm Capture	Hardness (mg/L)	Total (mg/L)			Dissolved (mg/L)		
							Cu	Pb	Zn	Cu	Pb	Zn
March 25, 1999	Rosemead Maintenance Station	073218	Fossil Filter™	Effluent	80	27	18	20	160	11	2.7	89
April 6, 1999	Foothill Maintenance Station	073216	StreamGuard™	Effluent	34	23	25	10	275	14	0.61	180
April 6, 1999	Foothill Maintenance Station	073216	Fossil Filter™	Effluent	97	17	23	43	225	5.3	0.72	54
April 6, 1999	Las Flores Maintenance Station	073217	StreamGuard™	Effluent	74	38	19	5.9	62	13	<0.50	33
April 6, 1999	Rosemead Maintenance Station	073218	StreamGuard™	Effluent	83	23	22	37	265	9.8	0.97	130
April 6, 1999	Rosemead Maintenance Station	073218	Fossil Filter™	Effluent	68	59	59	110	460	12	4.7	120J
April 12, 1999	Foothill Maintenance Station	073216	StreamGuard™	Effluent	61	<7.0	5.4	4.6	73	3.2	<0.50	54
April 12, 1999	Foothill Maintenance Station	073216	Fossil Filter™	Effluent	99	13	7.5	9.5	82	4	<0.50	45

Table 1-3 (Concluded)
Trace Metals and Hardness Data from Effluent Samples

Sample Date	BMP Location	Site ID	BMP Type	Sampling Location	% Storm Capture	Hardness (mg/L)	Total (mg/L)			Dissolved (mg/L)		
							Cu	Pb	Zn	Cu	Pb	Zn
April 12, 1999	Las Flores Maintenance Station	073217	StreamGuard™	Effluent	84	37	17	7.8	71	7.7	<0.50	18
April 11, 1999	Las Flores Maintenance Station	073217	Fossil Filter™	Effluent	96	13	8.6	3.6	66	4.7	<0.50	34
April 12, 1999	Rosemead Maintenance Station	073218	StreamGuard™	Effluent	99	18	13	12	145	9.1	0.98	100
April 12, 1999	Rosemead Maintenance Station	073218	Fossil Filter™	Effluent	94	21	14	16	195	8.9	3.9	135

1.4.3 Conventional and Other Contaminants

Conventional and other contaminant data are presented in Table 1-4. Conventional constituents include pH, specific conductance, total suspended solids; other constituents include nutrients and hydrocarbons.

1.4.4 Solids Material Sampling Results

As part of the pollutant removal efficiency evaluation, DII media and the material collected within the DIIs were analyzed. Unused DII media was also analyzed to assess background concentrations of the DIIs. The following DII components and materials were tested:

StreamGuardä DII	**Fossil Filterä DII**
Geotextile fabric	Adsorbent material
Absorbent material	Debris/litter/sediment
Debris/litter/sediment	

Results of the analyses are summarized in Table 1-5.

Table 1-4
Conventional and Other Constituent Data from Effluent Samples

Sample Date	BMP Location	Site ID	DII Type	Sampling Location	% Storm Capture	pH	Specific Conductance (umhos/cm)	TSS (mg/L)	Nitrate-Nitrogen[(1)] (mg/L)	TKN[(1)] (mg/L)	Total P[(1)] (mg/L)	TPH Diesel (mg/L)	TPH Gasoline (mg/L)	TPH Oil (mg/L)
January 25, 1999	Foothill Maintenance Station	073216	StreamGuard™	Effluent	58	6.8	45	38	---	---	---	310	560	290
January 25, 1999	Foothill Maintenance Station	073216	Fossil Filter™	Effluent	93	7.1	48	38	---	---	---	250	<50	350
January 25, 1999	Las Flores Maintenance Station	073217	StreamGuard™	Effluent	50	6.8	150	50	---	---	---	760	<50	630
January 25, 1999	Las Flores Maintenance Station	073217	Fossil Filter™	Effluent	16	7.3	68	90	---	---	---	370	<50	240
January 31, 1999	Las Flores Maintenance Station	073217	StreamGuard™	Effluent	99	6.7	140	220	---	---	---	420	<50	360
January 31, 1999	Las Flores Maintenance Station	073217	Fossil Filter™	Effluent	99	6.8	115	58	---	---	---	710	<50	370
January 31, 1999	Rosemead Maintenance Station	073218	StreamGuard™	Effluent	99	6.9	46	50	---	---	---	340	<50	210
January 31, 1999	Rosemead Maintenance Station	073218	Fossil Filter™	Effluent	89	7.2	47	42	---	---	---	210	<50	120
February 9, 1999	Las Flores Maintenance Station	073217	Fossil Filter™	Effluent	99	9.2	155	80	---	---	---	270	<50	250
February 9, 1999	Rosemead Maintenance Station	073218	StreamGuard™	Effluent	99	7.4	110	100	---	---	---	410	89	200
February 9, 1999	Rosemead Maintenance Station	073218	Fossil Filter™	Effluent	35	7.6	64	320	---	---	---	140	<50	110
March 25, 1999	Foothill Maintenance Station	073216	StreamGuard™	Effluent	81	6.9	41	4	0.67	1.49	0.06	290	54	240
March 25, 1999	Foothill Maintenance Station	073216	Fossil Filter™	Effluent	79	7.1	130	34	0.74	1.68	0.10	390	240	430
March 25, 1999	Las Flores Maintenance Station	073217	StreamGuard™	Effluent	32	6.7	110	60	0.45	1.05	0.13	340	<50	230
March 25, 1999	Las Flores Maintenance Station	073217	Fossil Filter™	Effluent	83	6.9	53	80	0.38	0.86	0.10	270	<50	260
March 25, 1999	Rosemead Maintenance Station	073218	StreamGuard™	Effluent	99	6.9	76	82	0.96	2.67	0.20	590	460	480

Table 1-4 (Concluded)
Conventional and Other Constituent Data from Effluent Samples

Sample Date	BMP Location	Site ID	DII Type	Sampling Location	% Storm Capture	pH	Specific Conductance (umhos/cm)	TSS (mg/L)	Nitrate-Nitrogen(1) (mg/L)	TKN(1) (mg/L)	Total P(1) (mg/L)	TPH Diesel (mg/L)	TPH Gasoline (mg/L)	TPH Oil (mg/L)
March 25, 1999	Rosemead Maintenance Station	073218	Fossil Filter™	Effluent	80	7.4	74	44	0.81	1.22	0.09	420	240	670
April 6, 1999	Foothill Maintenance Station	073216	StreamGuard™	Effluent	34	7.1	98	36	0.98	2.45	0.10	460	62	200
April 6, 1999	Foothill Maintenance Station	073216	Fossil Filter™	Effluent	97	7.1	30	78	0.43	1.27	0.15	190	66	180
April 6, 1999	Las Flores Maintenance Station	073217	StreamGuard™	Effluent	74	6.7	105	72	1.1	1.52	0.21	380	<50	350
April 6, 1999	Rosemead Maintenance Station	073218	StreamGuard™	Effluent	83	7.1	54	68	0.52	1.53	0.14	250	77	260
April 6, 1999	Rosemead Maintenance Station	073218	Fossil Filter™	Effluent	68	7.5	130	130	0.71	2.62	0.24	330	<50	300
April 12, 1999	Foothill Maintenance Station	073216	StreamGuard™	Effluent	61	7.0	25	6	0.34	2.4	0.181	160	<50	98
April 12, 1999	Foothill Maintenance Station	073216	Fossil Filter™	Effluent	99	7.3	34	16	0.39	1.01	0.077	240	<50	260
April 12, 1999	Las Flores Maintenance Station	073217	StreamGuard™	Effluent	84	6.8	96	24	0.94	1.49	0.28	260	<50	160
April 11, 1999	Las Flores Maintenance Station	073217	Fossil Filter™	Effluent	96	7.0	38	37	0.27	0.71	0.079	270	<50	240
April 12, 1999	Rosemead Maintenance Station	073218	StreamGuard™	Effluent	99	7.5	57	26	0.62	1.45	0.105	230	<50	190
April 12, 1999	Rosemead Maintenance Station	073218	Fossil Filter™	Effluent	94	7.4	58	14	0.58	0.99	0.122	160	<50	110

(1) Analysis requested by Caltrans for effluent samples from drain inlet inserts beginning on 3/25/99 but not required as part of OMM Plan. The OMM Plan will be revised to list these as required analyses for the 1999/2000 wet season.

Table 1-5
Solids Material Sampling Data

Sample Date	BMP Location	Site ID	Total (mg/kg)			TRPH (mg/kg)	Mass (grams)
			Cu	Pb	Zn		
February 2, 1999	Unused - StreamGuard™ Fabric	---	0.22	<0.10	3.8	684	943.9
February 2, 1999	Unused - StreamGuard™ Absorbent	---	0.24	<0.10	0.6	1970	443.15
February 2, 1999	Unused - Fossil Filter™ Adsorbent	---	0.2	1.2	1.2	26.6	380.84
January 29, 1999	Used - StreamGuard™ Fabric	073216	17.7	46.4	509	1130	1331
January 29, 1999	Used - StreamGuard™ Absorbent	073216	2.0	2.3	20.1	2620	465.1
January 29, 1999	Used - StreamGuard™ Sediment	073216	31.9	41.8	377	58000	100
January 29, 1999	Used - Fossil Filter™ Adsorbent	073216	10.5	15.9	135	1910	3065
January 29, 1999	Used - Fossil Filter™ Sediment	073216	22.4	51.5	384	1610	120
April 8, 1999	Used - StreamGuard™ Fabric	073216	24.7	61.6	522	3670	1122
April 8, 1999	Used - StreamGuard™ Absorbent	073216	1.7	2.7	13.6	17900	493
April 8, 1999	Used - StreamGuard™ Sediment	073216	36.6	60.2	422	12500	177
April 8, 1999	Used - Fossil Filter™ Adsorbent	073216	5.5	11.9	43.5	11100	3964
April 8, 1999	Used - Fossil Filter™ Sediment	073216	38.4	110	321	12200	472
April 12, 1999	Used - StreamGuard™ Fabric	073216	9.9	23.5	162	2570	1420
April 12, 1999	Used - StreamGuard™ Absorbent	073216	0.3	0.25	2.8	2590	459
April 12, 1999	Used - Fossil Filter™ Adsorbent	073216	8.6	17.3	89.5	3300	3680
April 12, 1999	Used - Fossil Filter™ Sediment	073216	20.9	36.3	177	16800	191

1.5 Preliminary Bmp Performance Evaluations

To estimate the removal efficiency of contaminants from a DII, the quantity and quality of runoff entering the DII was compared to the quantity and quality of effluent discharged from the DII. To assess the influent quality and quantity, a mass balance was performed using effluent water quality and quantity data and quality and quantity data of material collected by the DII. These data allowed an estimate of the total reduction in mass loadings for a variety of contaminants. The quantity and quality of effluent is based on sampled events and does not account for nuisance flow or runoff generated from storm events not meeting the deployment criteria defined in the OMM Plan. The reporting limit was used when analytical concentrations were less than the laboratory reporting limit. The following mass balance equation was used to estimate the influent quantity and quantity:

Influent Mass Loading = (Used Insert Mass Loading – Unused Insert Mass Loading) + Effluent Mass Loading

Once the Influent Mass loading was estimated, the DII pollutant removal efficiency was estimated using the following equation:

Efficiency (%) = [(Influent Mass Loading – Effluent Mass Loading)/Influent Mass Loading] x 100

Preliminary BMP efficiencies were estimated for three StreamGuard™ DIIs and three Fossil Filter™ DIIs, which were installed at the Foothill Maintenance Station. Inserts were targeted to receive 0.5 inch of rainfall. Table 1-6 summarizes results and Worksheets 1 through 6 present the mass balance calculations.

Table 1-6
Preliminary BMP Pollutant Removal Efficiency Results

Insert Type	Copper	Lead	Zinc	TPH
StreamGuard™ - 1st DII evaluated	2%	7%	6%	7%
StreamGuard™ - 2nd DII evaluated	1%	4%	1%	8%
StreamGuard™ - 3rd DII evaluated	2%	5%	2%	7%
Fossil Filter™ - 1st DII evaluated	2%	4%	3%	10%
Fossil Filter™ - 2nd DII evaluated	1%	2%	1%	37%
Fossil Filter™ - 3rd DII evaluated	2%	3%	2%	11%

Worksheet 1

StreamGuard DII - 1st Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Copper	Used StreamGuard Geotextile Fabric	17.7	1331	---	---	0.000052
Copper	Used StreamGuard Absorbent Material	2	465.1	---	---	0.000002
Copper	Used StreamGuard Debris/litter/sediment	31.9	100	---	---	0.000007
Copper	*Used Media Subtotal*			---	---	*0.000*
Copper	Unused StreamGuard Geotextile Fabric	0.22	943.9	---	---	0.000000
Copper	Unused StreamGuard Absorbent Material	0.24	443.15	---	---	0.000000
Copper	*Unused Media Subtotal*			---	---	*0.000*
Copper	*Effluent Water from 25 January 1999 storm event*	---	---	*17*	*2764*	*0.003*
Copper	Estimated Influent Load					0.003
Copper	**Efficiency (%)**					**2%**

StreamGuard DII - 1st Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Lead	Used StreamGuard Geotextile Fabric	46.4	1331	---	---	0.000136
Lead	Used StreamGuard Absorbent Material	2.3	465.1	---	---	0.000002
Lead	Used StreamGuard Debris/litter/sediment	41.8	100	---	---	0.000009
Lead	*Used Media Subtotal*			---	---	*0.000*
Lead	Unused StreamGuard Geotextile Fabric	0.1	943.9	---	---	0.000000
Lead	Unused StreamGuard Absorbent Material	0.1	443.15	---	---	0.000000
Lead	*Unused Media Subtotal*			---	---	*0.000*
Lead	*Effluent Water from 25 January 1999 storm event*	---	---	*12*	*2764*	*0.002*
Lead	Estimated Influent Load					0.002
Lead	**Efficiency (%)**					**7%**

StreamGuard DII - 1st Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Zinc	Used StreamGuard Geotextile Fabric	509	1331	---	---	0.001490
Zinc	Used StreamGuard Absorbent Material	20.1	465.1	---	---	0.000021
Zinc	Used StreamGuard Debris/litter/sediment	377	100	---	---	0.000083
Zinc	*Used Media Subtotal*			---	---	*0.002*
Zinc	Unused StreamGuard Geotextile Fabric	3.8	943.9	---	---	0.000008
Zinc	Unused StreamGuard Absorbent Material	0.6	443.15	---	---	0.000001
Zinc	*Unused Media Subtotal*			---	---	*0.000*
Zinc	*Effluent Water from 25 January 1999 storm event*	---	---	*140*	*2764*	*0.024*
Zinc	Estimated Influent Load					0.026
Zinc	**Efficiency (%)**					**6%**

StreamGuard DII - 1st Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
TPH	Used StreamGuard Geotextile Fabric	1130	1331	---	---	0.003309
TPH	Used StreamGuard Absorbent Material	2620	465.1	---	---	0.002681
TPH	Used StreamGuard Debris/litter/sediment	58000	100	---	---	0.012760
TPH	*Used Media Subtotal*			---	---	*0.019*
TPH	Unused StreamGuard Geotextile Fabric	684	943.9	---	---	0.001420
TPH	Unused StreamGuard Absorbent Material	1970	443.15	---	---	0.001921
TPH	*Unused Media Subtotal*			---	---	*0.003*
TPH	*Effluent Water from 25 January 1999 storm event*	---	---	*1160*	*2764*	*0.200*
TPH	Estimated Influent Load					0.215
TPH	**Efficiency (%)**					**7%**

Worksheet 2

StreamGuard DII - 2nd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Copper	Used StreamGuard Geotextile Fabric	24.7	1122	---	---	0.000061
Copper	Used StreamGuard Absorbent Material	1.7	493	---	---	0.000002
Copper	Used StreamGuard Debris/litter/sediment	36.6	177	---	---	0.000014
Copper	*Used Media Subtotal*			---	---	*0.000*
Copper	Unused StreamGuard Geotextile Fabric	0.22	943.9	---	---	0.000000
Copper	Unused StreamGuard Absorbent Material	0.24	443.15	---	---	0.000000
Copper	*Unused Media Subtotal*			---	---	*0.000*
Copper	Effluent Water from 25 March 1999 storm event	---	---	8.3	1088	0.001
Copper	Effluent Water from 6 April 1999 storm event	---	---	25	6735	0.010
Copper	*Effluent Subtotal*					*0.011*
Copper	Estimated Influent Load					0.011
Copper	**Efficiency (%)**					**1%**

StreamGuard DII - 2nd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Lead	Used StreamGuard Geotextile Fabric	61.6	1122	---	---	0.000152
Lead	Used StreamGuard Absorbent Material	2.7	493	---	---	0.000003
Lead	Used StreamGuard Debris/litter/sediment	60.2	177	---	---	0.000023
Lead	*Used Media Subtotal*			---	---	*0.000*
Lead	Unused StreamGuard Geotextile Fabric	0.1	943.9	---	---	0.000000
Lead	Unused StreamGuard Absorbent Material	0.1	443.15	---	---	0.000000
Lead	*Unused Media Subtotal*			---	---	*0.000*
Lead	Effluent Water from 25 March 1999 storm event	---	---	2.6	1088	0.000
Lead	Effluent Water from 6 April 1999 storm event	---	---	10	6735	0.004
Lead	*Effluent Subtotal*					*0.004*
Lead	Estimated Influent Load					0.005
Lead	**Efficiency (%)**					**4%**

StreamGuard DII - 2nd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Zinc	Used StreamGuard Geotextile Fabric	522	1122	---	---	0.001289
Zinc	Used StreamGuard Absorbent Material	13.6	493	---	---	0.000015
Zinc	Used StreamGuard Debris/litter/sediment	422	177	---	---	0.000164
Zinc	*Used Media Subtotal*			---	---	*0.001*
Zinc	Unused StreamGuard Geotextile Fabric	3.8	943.9	---	---	0.000008
Zinc	Unused StreamGuard Absorbent Material	0.6	443.15	---	---	0.000001
Zinc	*Unused Media Subtotal*			---	---	*0.000*
Zinc	Effluent Water from 25 March 1999 storm event	---	---	96	1088	0.007
Zinc	Effluent Water from 6 April 1999 storm event	---	---	275	6735	0.115
Zinc	*Effluent Subtotal*					*0.122*
Zinc	Estimated Influent Load					0.123
Zinc	**Efficiency (%)**					**1%**

StreamGuard DII - 2nd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
TPH	Used StreamGuard Geotextile Fabric	3670	1122	---	---	0.009059
TPH	Used StreamGuard Absorbent Material	17900	493	---	---	0.019414
TPH	Used StreamGuard Debris/litter/sediment	12500	177	---	---	0.004868
TPH	*Used Media Subtotal*			---	---	*0.033*
TPH	Unused StreamGuard Geotextile Fabric	684	943.9	---	---	0.001420
TPH	Unused StreamGuard Absorbent Material	1970	443.15	---	---	0.001921
TPH	*Unused Media Subtotal*			---	---	*0.003*
TPH	Effluent Water from 25 March 1999 storm event	---	---	584	1088	0.040
TPH	Effluent Water from 6 April 1999 storm event	---	---	722	6735	0.303
TPH	*Effluent Subtotal*					*0.343*

Worksheet 3

StreamGuard DII - 3rd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Copper	Used StreamGuard Geotextile Fabric	9.9	1420	---	---	0.000031
Copper	Used StreamGuard Absorbent Material	0.3	459	---	---	0.000000
Copper	*Used Media Subtotal*			---	---	*0.000*
Copper	Unused StreamGuard Geotextile Fabric	0.22	943.9	---	---	0.000000
Copper	Unused StreamGuard Absorbent Material	0.24	443.15	---	---	0.000000
Copper	*Unused Media Subtotal*			---	---	*0.000*
Copper	*Effluent Water from 12 April 1999 storm event*	---	---	*5.4*	*5331*	*0.002*
Copper	Estimated Influent Load					0.002
Copper	**Efficiency (%)**					**2%**

StreamGuard DII - 3rd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Lead	Used StreamGuard Geotextile Fabric	23.5	1420	---	---	0.000073
Lead	Used StreamGuard Absorbent Material	0.25	459	---	---	0.000000
Lead	*Used Media Subtotal*			---	---	*0.000*
Lead	Unused StreamGuard Geotextile Fabric	0.1	943.9	---	---	0.000000
Lead	Unused StreamGuard Absorbent Material	0.1	443.15	---	---	0.000000
Lead	*Unused Media Subtotal*			---	---	*0.000*
Lead	*Effluent Water from 12 April 1999 storm event*	---	---	*4.6*	*5331*	*0.002*
Lead	Estimated Influent Load					0.002
Lead	**Efficiency (%)**					**5%**

StreamGuard DII - 3rd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Zinc	Used StreamGuard Geotextile Fabric	162	1420	---	---	0.000506
Zinc	Used StreamGuard Absorbent Material	2.8	459	---	---	0.000003
Zinc	*Used Media Subtotal*			---	---	*0.001*
Zinc	Unused StreamGuard Geotextile Fabric	3.8	943.9	---	---	0.000008
Zinc	Unused StreamGuard Absorbent Material	0.6	443.15	---	---	0.000001
Zinc	*Unused Media Subtotal*			---	---	*0.000*
Zinc	*Effluent Water from 12 April 1999 storm event*	---	---	*73*	*5331*	*0.024*
Zinc	Estimated Influent Load					0.025
Zinc	**Efficiency (%)**					**2%**

StreamGuard DII - 3rd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
TPH	Used StreamGuard Geotextile Fabric	2570	1420	---	---	0.008029
TPH	Used StreamGuard Absorbent Material	2590	459	---	---	0.002615
TPH	*Used Media Subtotal*			---	---	*0.011*
TPH	Unused StreamGuard Geotextile Fabric	684	943.9	---	---	0.001420
TPH	Unused StreamGuard Absorbent Material	1970	443.15	---	---	0.001921
TPH	*Unused Media Subtotal*			---	---	*0.003*
TPH	*Effluent Water from 12 April 1999 storm event*	---	---	*308*	*5331*	*0.102*
TPH	Estimated Influent Load					0.110
TPH	**Efficiency (%)**					**7%**

Note: There was no sediment to analyze and include in the efficiency calculations.

Worksheet 4

Fossil Filter DII - 1st Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Copper	Used Fossil Filter Adsorbent	10.5	3065	---	---	0.000071
Copper	Used Fossil Filter Debris/litter/sediment	22.4	120	---	---	0.000006
Copper	*Used Media Subtotal*			---	---	*0.000*
Copper	*Unused Fossil Filter Adsorbent*	*0.2*	*1900*	---	---	*0.000001*
Copper	*Effluent Water from 25 January 1999 storm event*	---	---	*17*	*2845*	*0.003*
Copper	Estimated Influent Load					0.003
Copper	**Efficiency (%)**					**2%**

Fossil Filter DII - 1st Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Lead	Used Fossil Filter Adsorbent	15.9	3065	---	---	0.000107
Lead	Used Fossil Filter Debris/litter/sediment	51.5	120	---	---	0.000014
Lead	*Used Media Subtotal*			---	---	*0.000*
Lead	*Unused Fossil Filter Adsorbent*	*1.2*	*1900*	---	---	*0.000005*
Lead	*Effluent Water from 25 January 1999 storm event*	---	---	*17*	*2845*	*0.003*
Lead	Estimated Influent Load					0.003
Lead	**Efficiency (%)**					**4%**

Fossil Filter DII - 1st Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Zinc	Used Fossil Filter Adsorbent	135	3065	---	---	0.000910
Zinc	Used Fossil Filter Debris/litter/sediment	384	120	---	---	0.000101
Zinc	*Used Media Subtotal*			---	---	*0.001*
Zinc	*Unused Fossil Filter Adsorbent*	*1.2*	*1900*	---	---	*0.000005*
Zinc	*Effluent Water from 25 January 1999 storm event*	---	---	*160*	*2845*	*0.028*
Zinc	Estimated Influent Load					0.029
Zinc	**Efficiency (%)**					**3%**

Fossil Filter DII - 1st Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
TPH	Used Fossil Filter Adsorbent	1910	3065	---	---	0.012879
TPH	Used Fossil Filter Debris/litter/sediment	1610	120	---	---	0.000425
TPH	*Used Media Subtotal*			---	---	*0.013*
TPH	*Unused Fossil Filter Adsorbent*	*26.6*	*1900*	---	---	*0.000111*
TPH	*Effluent Water from 25 January 1999 storm event*	---	---	*650*	*2845*	*0.115*
TPH	Estimated Influent Load					0.128
TPH	**Efficiency (%)**					**10%**

Note: Each Fossil Filter DII used approximately 1900 grams of adsorbent material.

Worksheet 5

Fossil Filter DII - 2nd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Copper	Used Fossil Filter Adsorbent	5.5	3964	---	---	0.000048
Copper	Used Fossil Filter Debris/litter/sediment	38.4	472	---	---	0.000040
Copper	*Used Media Subtotal*			---	---	*0.000*
Copper	*Unused Fossil Filter Adsorbent*	*0.2*	*1900*	---	---	*0.000001*
Copper	Effluent Water from 25 March 1999 storm event	---	---	20	1020	0.001
Copper	Effluent Water from 6 April 1999 storm event	---	---	23	4350	0.006
Copper	*Effluent Subtotal*					*0.008*
Copper	Estimated Influent Load					0.008
Copper	**Efficiency (%)**					**1%**

Fossil Filter DII - 2nd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Lead	Used Fossil Filter Adsorbent	11.9	3964	---	---	0.000104
Lead	Used Fossil Filter Debris/litter/sediment	110	472	---	---	0.000114
Lead	*Used Media Subtotal*			---	---	*0.000*
Lead	*Unused Fossil Filter Adsorbent*	*1.2*	*1900*	---	---	*0.000005*
Lead	Effluent Water from 25 March 1999 storm event	---	---	16	1020	0.001
Lead	Effluent Water from 6 April 1999 storm event	---	---	43	4350	0.012
Lead	*Effluent Subtotal*					*0.013*
Lead	Estimated Influent Load					0.013
Lead	**Efficiency (%)**					**2%**

Fossil Filter DII - 2nd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Zinc	Used Fossil Filter Adsorbent	43.5	3964	---	---	0.000379
Zinc	Used Fossil Filter Debris/litter/sediment	321	472	---	---	0.000333
Zinc	*Used Media Subtotal*			---	---	*0.001*
Zinc	*Unused Fossil Filter Adsorbent*	*1.2*	*1900*	---	---	*0.000005*
Zinc	Effluent Water from 25 March 1999 storm event	---	---	160	1020	0.010
Zinc	Effluent Water from 6 April 1999 storm event	---	---	225	4350	0.061
Zinc	*Effluent Subtotal*					*0.071*
Zinc	Estimated Influent Load					0.072
Zinc	**Efficiency (%)**					**1%**

Fossil Filter DII - 2nd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
TPH	Used Fossil Filter Adsorbent	11100	3964	---	---	0.096801
TPH	Used Fossil Filter Debris/litter/sediment	12200	472	---	---	0.012668
TPH	*Used Media Subtotal*			---	---	*0.109*
TPH	*Unused Fossil Filter Adsorbent*	*26.6*	*1900*	---	---	*0.000111*
TPH	Effluent Water from 25 March 1999 storm event	---	---	1060	1020	0.067
TPH	Effluent Water from 6 April 1999 storm event	---	---	436	4350	0.118
TPH	*Effluent Subtotal*					*0.186*
TPH	Estimated Influent Load					0.295
TPH	**Efficiency (%)**					**37%**

Note: Each Fossil Filter DII used approximately 1900 grams of adsorbent material.

Worksheet 6

Fossil Filter DII - 3rd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Copper	Used Fossil Filter Adsorbent	8.6	3680	---	---	0.000070
Copper	Used Fossil Filter Debris/litter/sediment	20.9	191	---	---	0.000009
Copper	*Used Media Subtotal*			---	---	*0.000*
Copper	*Unused Fossil Filter Adsorbent*	*0.2*	*1900*	---	---	*0.000001*
Copper	*Effluent Water from 12 April 1999 storm event*	---	---	*7.5*	*8110*	*0.004*
Copper	Estimated Influent Load					0.004
Copper	**Efficiency (%)**					**2%**

Fossil Filter DII - 3rd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Lead	Used Fossil Filter Adsorbent	17.3	3680	---	---	0.000140
Lead	Used Fossil Filter Debris/litter/sediment	36.3	191	---	---	0.000015
Lead	*Used Media Subtotal*			---	---	*0.000*
Lead	*Unused Fossil Filter Adsorbent*	*1.2*	*1900*	---	---	*0.000005*
Lead	*Effluent Water from 12 April 1999 storm event*	---	---	*9.5*	*8110*	*0.005*
Lead	Estimated Influent Load					0.005
Lead	**Efficiency (%)**					**3%**

Fossil Filter DII - 3rd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
Zinc	Used Fossil Filter Adsorbent	89.5	3680	---	---	0.000725
Zinc	Used Fossil Filter Debris/litter/sediment	177	191	---	---	0.000074
Zinc	*Used Media Subtotal*			---	---	*0.001*
Zinc	*Unused Fossil Filter Adsorbent*	*1.2*	*1900*	---	---	*0.000005*
Zinc	*Effluent Water from 12 April 1999 storm event*	---	---	*82*	*8110*	*0.041*
Zinc	Estimated Influent Load					0.042
Zinc	**Efficiency (%)**					**2%**

Fossil Filter DII - 3rd Evaluated Unit

Analyte	Media	Concentration (mg/kg)	Mass (grams)	Event Mean Concentration (ug/L)	Runoff Volume (ft^3)	Load (lbs)
TPH	Used Fossil Filter Adsorbent	3300	3680	---	---	0.026717
TPH	Used Fossil Filter Debris/litter/sediment	16800	191	---	---	0.007059
TPH	*Used Media Subtotal*			---	---	*0.034*
TPH	*Unused Fossil Filter Adsorbent*	*26.6*	*1900*	---	---	*0.000111*
TPH	*Effluent Water from 12 April 1999 storm event*	---	---	*550*	*8110*	*0.278*
TPH	Estimated Influent Load					0.312
TPH	**Efficiency (%)**					**11%**

Note: Each Fossil Filter DII used approximately 1900 grams of adsorbent material.

1.6 Baseline Soil Sampling At The Infiltration Basin

Core samples of the I-605/SR-91 Infiltration Basin (IB) floor were collected prior to the IB receiving runoff. Samples were collected to establish a baseline of soil conditions and will be used to assess impacts of pollutants to the soil. Nine cores were collected from locations on an equilateral basin grid (superimposed over the basin). Each of the nine cores was collected using a hand-held, stainless steel soil probe. The probe was driven 1 meter [3.28 ft] below the ground surface and the core was recovered. Each core was then subdivided into three sections as follows:

1. Section 1 from the ground surface to 0.3 m [0.98 ft] below the ground surface.
2. Section 2 was from 0.3 m [0.98 ft] to 0.5 m [1.64 ft] below the ground surface.
3. Section 3 was from 0.6 m [1.97 ft] to 0.8 m [2.62 ft] below the ground surface.

Section 1 of each core was discarded. Similar depth intervals of each core were combined to prepare two samples: one from the 0.3 m [0.98 ft] to 0.5 m [1.64 ft] below ground surface interval and one from the 0.6 m [1.97 ft] to 0.8 m [2.62 ft] below the ground surface. Samples were sent to Quanterra Laboratory for total metals and TRPH analyses and also to LawCrandall's materials testing laboratory for grain size distribution testing.

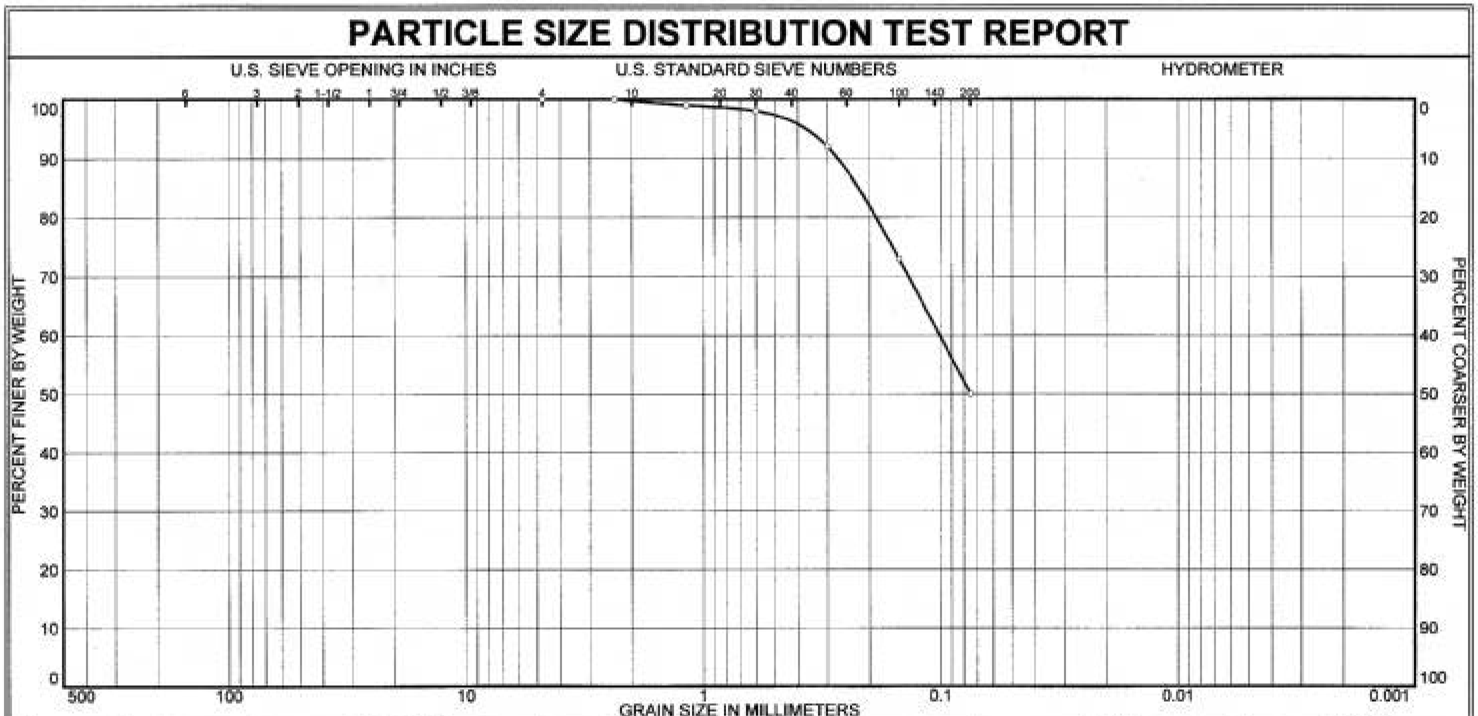
Analytical results are summarized in Table 1-7. Results of the grain size distribution tests are presented in Figures 1-4 and 1-5.

Soil samples from the IB floor will be collected again at the end of the 1999/2000 and 2000/2001 wet seasons. Results from future sampling rounds will be compared with results from the baseline samples to assess impacts of pollutants to the soil.

Table 1-7
Infiltration Basin Baseline Soil Sampling Results

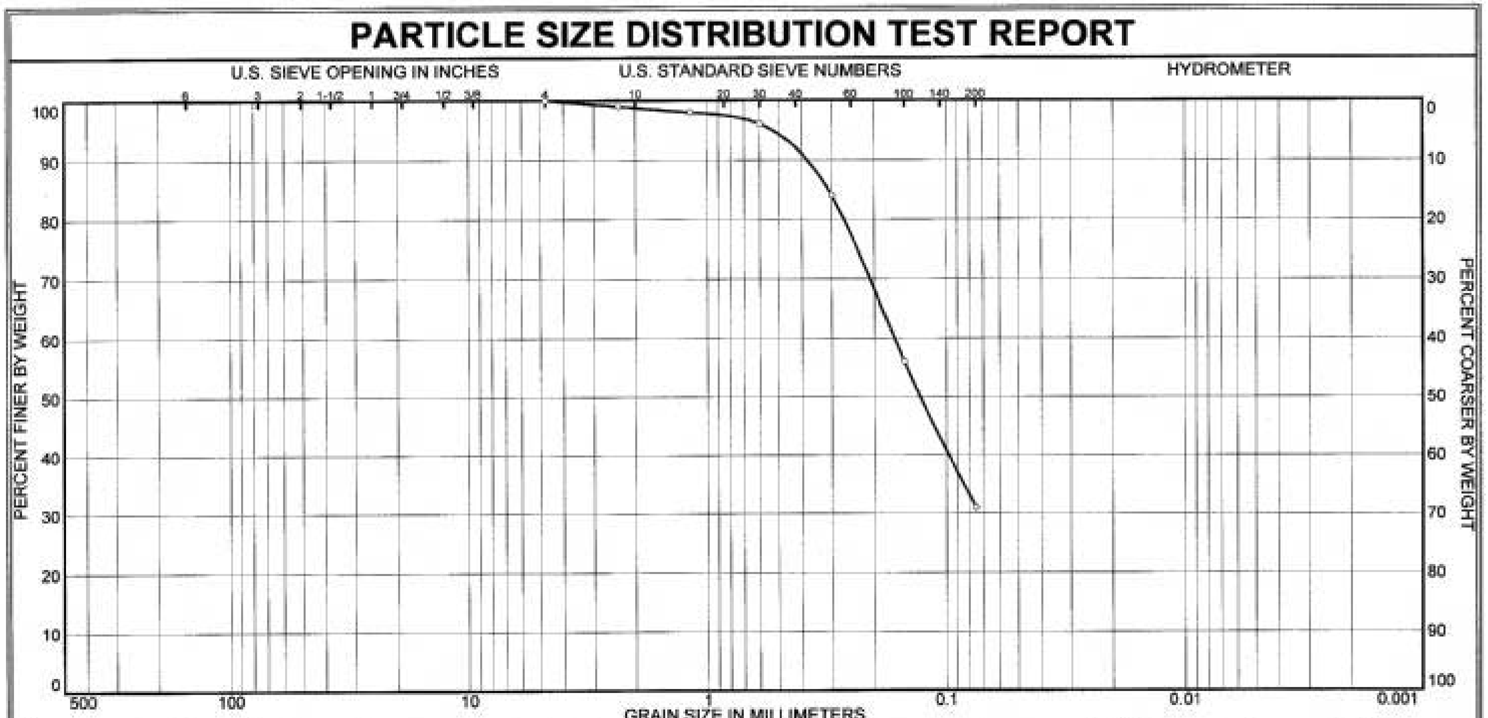
Sample Date	BMP Location/Soil Sampling Location	Site ID	BMP Type	Total (mg/kg)			TRPH (mg/kg)
				Cu	Pb	Zn	
January 28, 1999	I-605/91 Baseline Soil; 0.3-0.5 meter depth	073101	Infiltration Basin	19.5	5.1	45.9	<10.0
January 28, 1999	I-605/91 Baseline Soil; 0.6-0.8 meter depth	073101	Infiltration Basin	15.5	3.8	39.9	<10.0

Figure 1-4
Grain Size Distribution Curve (0.3-0.5 meter depth)



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	50.0	50.0	

Figure 1-5
Grain Size Distribution Curve (0.6-0.8 meter depth)



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	69.0	31.0	

2.0 BMP OPERATIONS

This section discusses the empirical observations performed during operation of the DIIs during the 1998/99 stormwater monitoring season. Two different DIIs were tested as part of the Caltrans BMP Retrofit Pilot Program and include the Fossil Filter™ DII (Photographs 2-1 and 2-2) and the StreamGuard™ DII (Photograph 2-7 and 2-8).

2.1 Introduction And Methods

Empirical observations are critical in assessing the overall performance of implemented water quality management practices and in ensuring that the practices are maintained at optimum levels. Other factors such as maintenance activities, environmental variability, and physical processes can influence the performance of a particular BMP. Some of these factors such as rainfall quantity, and rainfall intensity, were assessed through physical measurements. Other components such as trash build-up, sediment deposition, and runoff appearance were assessed through documented observations.

For a DII performance evaluation, the following observations were taken at the influent location, within the DII, and at the effluent location (i.e., sample collection point):

- Meteorological characteristics (present and preceding period);
- Hydrologic and hydraulic characteristics (flowing and/or standing water);
- Inlet conditions (problems affecting performance);
- Water quality appearance (visual, olfactory);
- Solids deposition (trash and debris, sediments, organics) and resuspension;
- Treatment medium condition;
- Outlet conditions (problems affecting performance);
- Mosquitoes and other vectors;
- Structural condition of facility; and
- Monitoring equipment condition.

2.2 Summary Of Empirical Observations And Bmp Operations

Empirical observations of the DIIs were performed during operation of the inserts during storm events. From January to mid-March 1999, empirical observations were recorded once during each storm event. From March 15, 1999 to the end of the monitoring season, observations were recorded approximately every two hours during storm events to gain a better understanding of how the BMPs functioned with time and flow rate.

Results of empirical observations for Fossil Filter™ and StreamGuard™ DIIs are provided in Tables 2-1 and 2-2, respectively. These tables provide a summary of observations as well as information concerning changes in maintenance frequency, maintenance thresholds, and operation of the BMPs during the monitoring season. Differences of varying degrees of maintenance and subsequent conclusions regarding the effectiveness of these DIIs are discussed in Section 2.3. Photographs referenced in Tables 2-1 and 2-2 are included at the end of this section.

2.3 Analysis Of Empirical Data

This section discusses conclusions derived from the empirical observations collected during operation of the BMPs in the 1998/99 stormwater monitoring season.

2.3.1 Criteria for Analysis and Evaluation of BMP Effectiveness

Two different criteria are used to evaluate the performance of a BMP. One method measures the effectiveness of the BMP to remove pollutants from storm water discharge. This analytical method is discussed in Section 1.3. The second method is based on empirical observations of the performance of BMPs during a storm event. For this discussion the criterion for successful BMP performance, based on empirical observations, is the ability of the BMP to capture and treat stormwater discharge. Discharge directed through the BMP and treated is considered a successful performance, regardless of the efficiency of the treatment. When runoff bypasses the BMP and enters the storm drain system untreated, this is considered an unsuccessful performance.

2.3.2 Maintenance Frequency vs. BMP Performance

Empirical observations of the drain inlet inserts showed that performance was related to the quantity of resources allocated to installation and maintenance. More careful installation and more frequent maintenance resulted in better performance (i.e., less flow bypass).

The Caltrans BMP Retrofit Pilot Program recognized this relationship. At the beginning of monitoring in January 1999 the DIIs were installed and maintained per the OMM Plan, which reflected practices recommended by the insert manufacturers. Due to the BMPs performance, improved installation procedures and more frequent maintenance were implemented during the following months. Tables 2-1 and 2-2 provide a timeline and summary of the observations.

2.3.3 Assessment of Maintenance Frequency vs. BMP Performance

To assess the relationship of maintenance frequency vs. performance, the following criteria are used:

1. Reasons for flow bypass are described for each BMP.
2. Changes in installation and/or maintenance, to improve performance, are discussed.
3. Resulting improvements in performance are described.

Fossil Filter™ DIIs will be discussed first, followed by StreamGuard™ DIIs.

2.3.3.1 Analysis of Fossil Filterä DIIs

Three reasons for flow bypass in Fossil Filter™ DIIs were observed:

1. Structural;
2. Hydraulic capacity; and
3. Blockage and clogging of cartridges.

One structural reason for bypass was that the Fossil Filter™ DII fitted poorly into the drain inlets. The Fossil Filter™ DII were manufactured for standard Caltrans inlets but they did not fit snugly into the standard inlets located at the maintenance stations. Although the edges of the inserts included rubber linings to press against the inlet edge and eliminate any open space, the rubber lining did not completely eliminate the gap. This was particularly noticeable at the inlet at Rosemead Maintenance Station where there was a gap of approximately 0.10 inch between the insert and inlet edge. Similar flow bypass, due to imperfect DII fit, was also observed at Las Flores Maintenance Station. Photograph 2-5 illustrates this type of flow bypass.

A second structural reason that allowed bypass at Rosemead Maintenance Station was that the Fossil Filter™ DII did not fit well in the curb inlet. The corners where the insert meets the cut-out section of curb allowed flow bypass with as little as 0.01 inch of precipitation (Photograph 2-6).

Hydraulic capacity was another factor that limited BMP performance. The Fossil Filter™ DIIs are designed to not impede flows (due to flood control considerations) they become ineffective at higher discharge rates. During higher discharge rates, runoff had sufficient velocity and/or volume to pass over the lip of the cartridges and go directly into the storm drain system. This was observed at Foothill Maintenance Station on March 15, 1999 (Photograph 2-3). Discharge from the drainage area measured 0.15 cfs (67 gpm) resulted in significant flow bypass.

The third factor that caused flow bypass was blockage and clogging of the DII. Blockage occurred from the accumulation of trash, debris, and sediment on top of the cartridge screens. This accumulation blocked the cartridge screens so that stormwater runoff could not pass through the screens. The resultant standing water pooled and eventually achieved a depth where it spilled over the cartridge lip into the storm drain. Clogging occurred when sediment passed through the cartridge screens and settled in the pore spaces between the adsorbent granules (Photograph 2-4). This appeared to cause a slowing in the infiltration of water through the adsorbent. Water pooled and reached a depth where it spilled over the cartridge lip into the storm drain.

Blockage of the cartridges initially was a consistent problem: trash, debris, and/or sediment accumulated on top of the cartridge screens (either from previous flow, wind or during the current event) and the DII cartridges became blocked. This method of failure was observed at all three maintenance stations. Clogging was observed during three storm events at Las Flores Maintenance Stations.

Mitigation of Structural Deficiencies Through Improved Installation Procedures

After the first two monitored storm events of the BMP Retrofit Pilot Program, manufacturer's installation procedures were supplemented. The minor amount of flow bypass due to the gap was eliminated at the Rosemead Maintenance Station by plugging the inlet-interface gap with foam material. However, when a better-fitting replacement Fossil Filter™ DII was installed by the manufacturer at Rosemead Maintenance Station in March 1999, Caltrans decided that it would be installed per manufacturer's recommendations and that no additional installation work would be done. Consequently the new Fossil Filter™ DII at Rosemead Maintenance Station had an inlet-interface gap of approximately 0.05 inch and a minor amount of flow bypass due to the gap was subsequently observed.

Mitigation of Blockage Through More Frequent Maintenance

In March 1999 Caltrans decided to test whether flow bypass could be decreased by increasing the maintenance frequency of the Fossil Filter™ DIIs. The OMM Plan, based on the manufacturer's recommendations, called for cleaning out the top of the cartridges when two inches of debris collected on top of the cartridge screens. Since the Fossil Filter™ DIIs had become blocked with trash, debris, or sediment, Caltrans decided to increase the frequency of trash/debris/sediment removal. Field teams were instructed to remove trash/debris/sediment from the cartridge screens whenever blockage appeared to be imminent. The result of this more frequent maintenance was that no more blockage of Fossil Filter™ DIIs was observed during storm events.

Conclusions for Fossil Filterä DIIs

During the 1998/99 storm monitoring season it was observed, through empirical observations, that improvements in installation procedures and more frequent maintenance could improve BMP performance for some of the causes of flow bypass. Table 2-3 summarizes these observations and conclusions.

2.3.3.2 Analysis of StreamGuardä DIIs

For StreamGuard™ DIIs flow bypass did not appear to be a problem and more frequent maintenance was not necessary. However, because sediment and oil sheens were detected in the effluent, Section 1.3 should be consulted for details concerning the treatment effectiveness of the StreamGuard™ DIIs. Structurally, the StreamGuard™ DII covered the entire drain inlet. There was some concern by Caltrans that there could be flow bypass between insert fabric-interface, which was not always flush against the drain inlet opening. This bypass was not observed during storm events. However, at Foothill and Rosemead Maintenance Stations, where the geometry of the inlet grates were more susceptible to an inlet-insert gap, wood was inserted into the area between the insert and inlet edge to form a tight seal.

Hydraulic capacity problems were not observed. Even during peak flows no bypass was observed. The cone of the StreamGuard™ DIIs is 24 inches in depth. When standing water in the cone reaches a depth of approximately 22 inches, bypass can occur through two openings in the side. However, the deepest standing water observed in the insert cone was 12 inches at Foothill Maintenance Station - during the same storm that caused severe flow bypass at the Fossil Filter™ DII at Foothill Maintenance Station.

Blockage and clogging were not observed because of the design of the StreamGuard™ DII. The entire insert is constructed of a permeable geotextile fabric. Therefore, if trash, debris and/or sediment accumulate in the bottom, runoff can still filter through the sides of the cone.

Table 2-1
Empirical Observations of Fossil Filterä Drain Inlet Inserts During 1998-1999 Stormwater Monitoring Season

				General (3)							Water Quality (3)					
Site ID (1)	**Date**	**Time In/Out**	**Team Leader's Initials (2)**	**Flow bypass**	**Inlet obstructions**	**Solids deposition**	**Outlet obstructions**	**Vectors**	**Structural concerns**	**Other comments**	**Odor**	**Floatables**	**Oil & grease**	**Color**	**Turbidity**	**Empirical Observations Comments**
DII at 073216 (Foothill Maintenance Station) installed prior to January 8, 1999. Cartridges of inserts made of galvanized steel; no post-installation modifications made.																
073216	1/25/99	0530/ 0550	BJB	Y	N	N	N	N	N	Y	--	--	--	BR	SC	• Cartridges had approximately 1 inch of standing water. Runoff generally flowed into cartridges and then either infiltrated through the adsorbent or bypassed into the DII overflow area.
DII adsorbent replaced in accordance with OMM Plan. 1st DII abso rbent replacement.																
073216	2/9/99	2200/ 2300	ME	N	Y	N	N	N	N	N	--	--	--	CL	--	• Some leaves in DII.
2nd DII adsorbent removed and replaced with new adsorbent (2nd DII replacement). Adsorbent not sent to laboratory for analysis because water quality sample from 9 February 1999 storm event was not collected.																
Galvanized DII cartridges replaced with stainless-steel by vendor. See photo. Per Caltrans direction, new adsorbent material replaced old (3rd DII absorbent replacement). Old adsorbent was not sent tolaboratory for analysis because no water quality samples were associated with it.																
073216	3/15/99	0400/ 1000	WJO	Y	Y	N	N	N	N	N	--	OM	--	BR, CL	CT, SC	• Flow rate exceeded DII's filtering capacity and bypassed into the overflow area. Bypass caused by flow rate and not blockage of cartridges, runoff bypasses DII (see Photograph 2-3).
Caltrans restarts storm event sampling activities in addition to empirical observations. Per Caltrans direction, new adsorbent material replaced old (4th DII adsorbent replacement). Old adsorbent was not sent to laboratory for analysis because no water quality samples were associated with it.																
073216	3/25/99	0745/ 1900	JM	N	N	N	Y	N	N	N	--	OG	SH	YE	SC	• Some suspended fines observed in runoff. • No bypass because trash/debris/sediment was continually removed from DII cartridges. • Shallow deposits of silt and sand in flume.
073216	4/6/99	0430/ 1650	BC	N	N	N	N	N	N	N	--	--	--	CL, GR	--, SC	• Observations at 1030 noted runoff that appeared to be slightly cloudy and gray.
5th DII adsorbent removed and replaced with new adsorbent (5th DII adsorbent replacement). DII adsorbent and collected sediment removed and sent to laboratory for analysis (2nd DII sent for analysis).																

Notes are included at the end of this table.

Table 2-1 (continued)
Empirical Observations of Fossil Filterä Drain Inlet Inserts During 1998-1999 Stormwater Monitoring Season

				General[3]							Water Quality[3]					
Site ID[1]	Date	Time In/Out	Team Leader's Initials[2]	Flow bypass	Inlet obstructions	Solids deposition	Outlet obstructions	Vectors	Structural concerns	Other comments	Odor	Floatables	Oil & grease	Color	Turbidity	Empirical Observations Comments
073216	4/11/99	1300/ 1910	SC	N	N	Y	N	N	N	N	--	--, OG	--, SH	BL, BR, CL	--	• Small leaves and twigs resuspended in DII.
DII at 073217 (Las Flores Maintenance Station) installed prior to January 8, 1999. Cartridges of inserts made of galvanized steel; no post-installation modifications made.																
073217	1/25/99	0230/ 0300	BJB	Y	N	N	N	N	N	Y	--	OG	SH	BR	SC	• Flow bypass due to water not infiltrating fast enough through the adsorbent material. Fine sediment blocking pores between adsorbent granules inside cartridges impeded filtering capacity. • Oil sheen observed in effluent downstream of DII.
073217	1/31/99	0700/ 0830	ME	N	Y	Y	Y	N	N	N	--	OG	SH	CL	--	• Leaves and sediment observed on top of cartridges. • Sediment deposition in flume.
073217	2/9/99	1515/ 1600	ME	Y	Y	Y	Y	N	N	N	--	OG	SH	CL	SC	• Flow bypass due to leaves and sediment blocking the cartridge screen. • Sediment deposition in flume.
Galvanized DII cartridges replaced with stainless-steel by vendor. Per Caltrans direction, new adsorbent material replaced old (1st DII replacement). Old adsorbent was not sent to laboratory for analysis.																
073217	3/15/99	0100/ 0730	GD	N	Y	N	N	N	N	N	--	OG, OM	SH	GR	SC	• Light oil sheen, some leaves in runoff.
073217	3/20/99	0001/ 0400	BJB	Y	N	N	N	N	N	Y	--	OG	SH	BR, CL	SC	• Slight flow bypass through the gap of the inlet-insert interface. Average of 0.5 inch standing water in trough, with occasional bypass into the overflow area even though there is no sediment/trash/debris on top of cartridge screen. Bypass possibly due to fine sediment blocking pores between adsorbent granules inside cartridges (see Photogra ph 2-4). • Three domesticated cats observed.

Notes are included at the end of this table.

Table 2-1 (continued)
Empirical Observations of Fossil Filterä Drain Inlet Inserts During 1998-1999 Stormwater Monitoring Season

Site ID (1)	Date	Time In/Out	Team Leader's Initials (2)	General (3): Flow bypass	Inlet obstructions	Solids deposition	Outlet obstructions	Vectors	Structural concerns	Other comments	Water Quality (3): Odor	Floatables	Oil & grease	Color	Turbidity	Empirical Observations Comments
Caltrans restarts storm event sampling activities in addition to empirical observations. Per Caltrans direction, new adsorbent material replaced old (2nd DII adsorbent replacement). Old adsorbent was not sent t o laboratory for analysis because no water quality samples were associated with it.																
073217	3/25/99	0510/ 1530	ME	N	N	N	N	N	N	N	--	--	--	CL	--	• None.
073217	4/6/99	0430/ 1330	SA	N	N	N	N	N	N	Y	--	--, OG	--, SH	CL, GR	--, CT	• Observations at 1040 noted runoff that appeared to be slightly cloudy and gray. • Leaves were continually removed from DII.
073217	4/11/99	0900/ 1250	SDM	N	N	N	N	N	N	Y	--	OG	SH	BL, BR, GR, VI, YE	--, SC	• Colors observed reflect colors of oil sheen. • Approximate 0.25 inch of standing water in DII cartridges, but not enough for flow bypass. Standing water in cartridge possibly due to slowed infiltration rate through adsorbent due to fine sediment blocking pores between adsorbent granules inside cartridges.
DII at 073218 (Rosemead Maintenance Station) installed prior to January 8, 1999. Cartridges of inserts made of galvanized steel; no post-installation modifications made.																
073218	1/25/99	0415/ 0459	BJB	Y	Y	Y	N	N	Y	N	--	OG	SH	CL	--	• Patches of sediment and debris covered approximate 25% of cartridge screen. • Oil sheen noted in effluent downstream of DII. • Most runoff flowed into cartridges and infiltrated through adsorbent granules and some runoff skimmed over cartridge lip into the bypass area.

Notes are included at the end of this table.

Table 2-1 (continued)
Empirical Observations of Fossil Filterä Drain Inlet Inserts During 1998-1999 Stormwater Monitoring Season

				General [3]							Water Quality [3]					
Site ID [1]	**Date**	**Time In/Out**	**Team Leader's Initials** [2]	**Flow bypass**	**Inlet obstructions**	**Solids deposition**	**Outlet obstructions**	**Vectors**	**Structural concerns**	**Other comments**	**Odor**	**Floatables**	**Oil & grease**	**Color**	**Turbidity**	**Empirical Observations Comments**
073218	1/31/99	0900/ 1000	ME	Y	Y	N	N	N	N	N	--	OG, TR	SH	CL	--	• Flow bypass apparently due to a gap at the inlet-insert interface fit (approximately 0.1 inch gap) and to blockage of cartridge screen by trash and leaves.
073218	2/9/99	1120/ 1200	ME	Y	Y	N	Y	N	N	N	--	--	--	CL	--	• Flow bypass due to poor inlet-insert interface fit (approximately 0.1 inch gap) and to blockage of cartridge screen by trash and leaves. • Sediment present in downstream flume.
The 0.1 inch gap between inlet and insert was plugged with plastic to prevent flow bypass at the interface. This was done (not in accordance with manufacturer's recommendations, but per Caltrans guidance) on February 20, 1999. Subsequently, on March 4, 1999 a better-fitting new DII, with stainless steel cartridges was installed and adsorbent granules were replaced. There was approximately a 0.05 inch interface gap with the new DII. Per Caltrans, trash/debris/sediment from top of DII cartridges was removed continually to prevent flow bypass due to blocked cartridge screens.																
073218	3/15/99	0200	BJB	Y	N	Y	N	N	N	Y	--	OG, OM	SH	CL	SC	• Flow bypass at inlet-interface gap (Photograph 2-5) and at northwestern corner (Photograph 2-6). No bypass over cartridge lip due to continuous removal of trash/debris/leaves from the DII. • Oil sheen noted in effluent in downstream flume.
Caltrans restarts storm event sampling activities in addition to empirical observations. Per Caltrans direction, new adsorbent material replaced old (2nd DII adsorbent replacement). Old adsorbent was not sent to laboratory for analysis because n o water quality samples were associated with it.																
073218	4/6/99	0530/ 1600	ME	Y	N	Y	N	N	N	Y	--	--, OG, TR	SH	CL	--	• Flow bypass at inlet-interface gap and at northwestern corner. No bypass over cartridge lip due to fact that trash/debris/ leaves were continually removed from DII.
073218	4/6/99	1403/ 0020 (on 4/13/99)	RMP/DR	N	N	N	N	N	N	N	--	SF	--	--, CL, WH	--, SC	• Flow bypass at inlet-interface gap and at northwestern corner. No bypass over cartridge lip due to continual removal of trash/debris/leaves from the DII.

Notes are included at the end of this table.

Table 2-1 (continued)
Empirical Observations of Fossil Filterä Drain Inlet Inserts During 1998-1999 Stormwater Monitoring Season

Notes:
1. See Table 1-1 for a cross-reference of Site ID and location.
2. Team members are from LAWCRANDALL
3. The following abbreviations are used:

N = No	HS = Hydrogen sulfide	OG = Oil & grease	SH = Oil sheen	CL = Colorless	SC = Some cloudiness but transparent
Y = Yes	MU = Musty	TR = Trash or debris	HF = Heavy floating concentration	RD = Red; OR = Orange	CT = Cloudy, translucent
-- = None	SW = Sewage	SF = Surface film	EM = Emulsion	YE = Yellow; GR = Green	HC = Heavy cloudiness, opaque
OT = Other	AM = Ammonia	OM = Organic material	DE = Deposit	BL = Blue; VI = Violet	
	HC = Hydrocarbon			BR = Brown; BK = Black	
	PH = Pesticide or herbicide			GR = Gray; WH = White	

Table 2-2
Empirical Observations of StreamGuardä Drain Inlet Inserts During 1998-1999 Stormwater Monitoring Season

Site ID [1]	Date	Time In/Out	Team Leader's Initials [2]	General: Flow bypass	Inlet obstructions	Solids deposition	Outlet obstructions	Vectors	Structural concerns	Other comments	Water Quality: Odor	Floatables	Oil & grease	Color	Turbidity	Empirical Observations Comments
DII at 073216 (Foothill Maintenance Station) installed prior to January 8, 1999, per manufacturer's instructions.																
073216	1/25/99	0530/ 0550	BJB	N	N	N	N	N	N	N	--	--	--	BR	SC	• No flow bypass observed.
DII replaced in accordance with OMM Plan. 1st DII replacement..																
073216	2/9/99	2200/ 2300	ME	N	Y	N	N	N	N	N	--	OG	SH	CL	SC	• Sediment and trash observed in DII.
2nd DII removed and replaced with new DII (2nd DII replacement). DII not sent to the laboratory for analysis because water quality samples for the 9 February 1999 storm event were not collected. For the new DII, wood was used to press the DII against the drain inlet wall to minimize flow bypass.																
073216	3/15/99	0400/ 1000	WJO	N	N	N	N	N	N	Y	--	--, OG, OM	--, SH	CL, BR	--, SC	• Up to 12 inches of standing water observed in cone of insert. No flow through bypass vents at top of cone observed.
Caltrans restarts storm event sampling activities. Per Caltrans direction, a new DII is installed (3rd DII replacement). Old DII was not sent to the laboratory for analysis because no water quality samples were associated with it.																
073216	3/25/99	0745/ 1900	JM	N	N	Y	N	N	N	Y	--	--, SF	--, SH	CL	--	• Sediment deposition in flume.

Notes are included at the end of this table.

Table 2-2 (continued)
Empirical Observations of StreamGuardä Drain Inlet Inserts During 1998-1999 Stormwater Monitoring Season

Site ID (1)	Date	Time In/Out	Team Leader's Initials (2)	General: Flow bypass	General: Inlet obstructions	General: Solids deposition	General: Outlet obstructions	General: Vectors	General: Structural concerns	General: Other comments	Water Quality: Odor	Water Quality: Floatables	Water Quality: Oil & grease	Water Quality: Color	Water Quality: Turbidity	Empirical Observations Comments
073216	4/6/99	0430/ 1650	BC	N	N	N	N	N	N	N	--	--	--	BR, CL	--, SC	• None.
073216	4/11/99	1040/ 1900	SC	N	N	N	N	N	N	N	--	--	--	CL	--	• None.
DII at 073217 (Las Flores Maintenance Station) installed prior to January 8, 1999, per manufacturer's instructions.																
073217	1/25/99	0230/ 0300	BJB	N	N	N	N	N	N	N	--	--	--	BR	--	• No flow bypass observed.
073217	1/31/99	0700/ 0830	ME	N	N	Y	N	N	N	N	--	OG, OM, TR	SH	CL	--	• Sediment and leaves observed in DII.
Per Caltrans, trash/debris/sediment from DII removed when necessary to prevent flow bypass due to blockage.																
073217	3/15/99	0100/ 0730	GD	N	N	N	N	N	N	N	--	OG, OM, SF	--, SH	GR	--, SC	• Light oil sheen observed in runoff.

Notes are included at the end of this table.

Table 2-2 (continued)
Empirical Observations of StreamGuardä Drain Inlet Inserts During 1998-1999 Stormwater Monitoring Season

Site ID (1)	Date	Time In/Out	Team Leader's Initials (2)	General: Flow bypass	Inlet obstructions	Solids deposition	Outlet obstructions	Vectors	Structural concerns	Other comments	Water Quality: Odor	Floatables	Oil & grease	Color	Turbidity	Empirical Observations Comments
073217	3/20/99	0001/ 0400	BJB	N	N	Y	N	N	N	Y	--	--	--	BR, CL	--, CT	• Approximately 12 inches of standing water in cone. • Approximately 30 leaves observed in cone. • Three domesticated cats observed.
Caltrans restarts storm event sampling activities. Per Caltrans direction, a new DII is installed (1st DII replacement). Old DII was not sent to the laboratory for analysis because no water quality samples were associated with it.																
073217	3/25/99	0510/ 1530	ME	N	N	N	N	N	N	N	--	--, OG, SF	--, SH	CL	--	• None.
073217	4/6/99	0430/ 1330	SA	N	N	Y	N	N	N	Y	--	--, OG, SF	--, SH	CL, BR	--, SC	• A few leaves deposited in cone, but did not appear to interfere with flow through DII. • Oil sheen noted both in influent and effluent.
073217	4/11/99	0900/ 1250	SDM/ RMP	N	Y	N	N	N	N	Y	--	--, OG, SF	--, SH	BL, GR, VI	--, SC	• Leaves temporarily blocked north side of drain inlet and were subsequently removed. • Colors observed reflect colors of oil sheen. • Approximate 0.25 inch of standing water in DII.
DII at 073218 (Rosemead Maintenance Station) installed prior to January 8, 1999 with no post-installation modifications made.																

Notes are included at the end of this table.

Table 2-2 (continued)
Empirical Observations of StreamGuardä Drain Inlet Inserts During 1998-1999 Stormwater Monitoring Season

				General							Water Quality					
Site ID (1)	**Date**	**Time In/Out**	**Team Leader's Initials (2)**	**Flow bypass**	**Inlet obstructions**	**Solids deposition**	**Outlet obstructions**	**Vectors**	**Structural concerns**	**Other comments**	**Odor**	**Floatables**	**Oil & grease**	**Color**	**Turbidity**	**Empirical Observations Comments**
073218	1/25/99	0415/ 0459	BJB	N	N	N	N	N	N	N	--	--	--	CL	--	• None.
073218	1/31/99	0900/ 1000	ME	N	N	N	N	N	N	N	--	OG	SH	CL	--	• None.
073218	2/9/99	1120/ 1200	ME	N	N	Y	N	N	N	N	--	--	--	CL	--	• Sediment and leaves deposited in DII.
1st DII removed and replaced with new DII (1st DII replacement). DII not sent to the laboratory for analysis because water quality samples for the 9 February 1999 storm event were not collected. For the new DII, wood was used to press the DII against the drain inlet wall to minimize flow bypass.																
Caltrans restarts storm event sampling activities. Per Caltrans direction, a new DII is installed (2nd DII replacement).																
073218	4/6/99	0530/ 1600	ME	N	N	Y	N	N	N	N	--	--, OG, SF,TR	SH	CL	--	• Trash and debris deposited in DII.

Notes are included at the end of this table.

Table 2-2 (continued)
Empirical Observations of StreamGuardä Drain Inlet Inserts During 1998-1999 Stormwater Monitoring Season

Site ID [(1)]	Date	Time In/Out	Team Leader's Initials [(2)]	General: Flow bypass	General: Inlet obstructions	General: Solids deposition	General: Outlet obstructions	General: Vectors	General: Structural concerns	General: Other comments	Water Quality: Odor	Water Quality: Floatables	Water Quality: Oil & grease	Water Quality: Color	Water Quality: Turbidity	Empirical Observations Comments
073218	4/11/99	1145/ 0020 (on 4/12/ 99)	RMP/DR	N	Y	Y	N	N	N	N	MU, SW	--, OG, SF, TR	--, SH	CL, GR, WH	--, CT, SC	• Prior to removal, leaves and twigs partially obstructed inlet and were observed in the DII.

Notes:
1. See Table 1-1 for a cross-reference of Site ID and location.
2. Team members are from LAWCRANDALL
3. The following abbreviations are used:

N = No
Y = Yes
-- = None
OT = Other

HS = Hydrogen sulfide
MU = Musty
SW = Sewage
AM = Ammonia
HC = Hydrocarbon
PH = Pesticide or herbicide

OG = Oil & grease
TR = Trash or debris
SF = Surface film
OM = Organic material

SH = Oil sheen
HF = Heavy floating concentration
EM = Emulsion
DE = Deposit

CL = Colorless
RD = Red; OR = Orange
YE = Yellow; GR = Green
BL = Blue; VI = Violet
BR = Brown; BK = Black
GR = Gray; WH = White

SC = Some cloudiness but transparent
CT = Cloudy, translucent
HC = Heavy cloudiness, opaque

Notes are included at the end of this table.

Table 2-3 Summary of Conclusions for Fossil Filterä Drain Inlet Inserts

Cause of Flow Bypass	Amount of Flow Bypass	Attempted Solution	Results	Advantages	Disadvantages
Structural: gap at inlet-insert interface.	Minor, due to surface tension effects and velocity of the runoff.	Closing of gap using foam.	Flow bypass eliminated.	1. Very effective. 2. Requires a one-time fix.	1. Gap sealant would have to be inspected regularly to ensure that there were no cracks or openings
Structural: poor performance in curb inlets.	Major.	None.	N/A	N/A	N/A
Hydraulic capacity limitations.	Major at higher discharge rates.	None. (1)	N/A	N/A	N/A
Blockage.	Major.	Removal of trash, debris and/or sediment from top of DII cartridges.	Flow bypass due to blockage eliminated.	Effective.	1. Labor intensive; field personnel are required to be at the site before and during a storm event. 2. Does not work for unpredictable non-stormwater discharges or non-forecasted events.
Clogging.	Major.	None. (2)	N/A	N/A	N/A

Notes:
N/A = Not applicable
1. Limited hydraulic capacity is a fixed disadvantage of drain inlet inserts.
2. A way to eliminate the problem appears to be removing and replacing adsorbent granules immediately prior to a storm event. This solution has several disadvantages: (a) removing and replacing adsorbent granules is labor intensive; (b) removed adsorbent materials are potentially hazardous waste and would have to be treated accordingly; and (c) if the sediment loading in the stormwater discharge were sufficiently elevated, the cartridge could become re-clogged during a storm event.

3.0 BMP AND SITE MAINTENANCE

3.1 INTRODUCTION AND METHODS

An effective program of regular site inspections and maintenance aids optimal operation and performance of BMPs. Such a program was implemented in Caltrans District 7 from January 1999, when DIIs became operational. The goal of the program was to inspect each DII site at least once a month. Based on the results of the inspections, maintenance activities were then performed to ensure the desired optimal performance of each DII.

3.1.1 Inspections

Each DII was inspected on a regular basis, as follows:

- Once a month at a minimum
- Within 10 days of storm events (with more than 0.10 inch of precipitation)
- At least weekly during extended periods of wet weather.

On arrival at the site, the BMP and adjacent area were inspected for:

- Sediment accumulation within the DIIs
- Ponded water or flow
- BMP performance (damage, blockage, fouling, short circuiting or resuspension)
- Vegetation
- Animals/vectors
- Structural damage to inlets/grates
- General aesthetics (graffiti, vandalism, trash and debris).

Observations were recorded on field forms.

3.1.2 Maintenance

The purpose of maintaining the BMPs and their adjacent sites is two fold:

- Functional i.e., for performance and safety
- Aesthetic considerations i.e., for public acceptance.

Maintenance activities at the DII sites were initially performed in accordance with the schedule described in Table 3-1, however, after observing stormwater runoff bypass at the Fossil Filter™ DIIs, maintenance frequencies were increased to minimize bypass. Maintenance activities were documented on field forms.

Table 3-1
Schedule of Maintenance Activities(1)

Maintenance Activity	Schedule
Removal of sediment from Fossil Filter™ DII	When sediment in trough is > 2 inches, or unit is clogged. Collected sediment was sent to a laboratory for analysis to determine DII efficiency.
Removal of sediment from StreamGuard™ DII	When there is > 6 inches of sediment in cone.
Replacement of adsorbent granules in Fossil Filter™ DII trough	When granules are dark gray or black or: • after 0.5 of cumulative precipitation at Foothill Maintenance Station, • after 4 inches of cumulative precipitation at Las Flores Maintenance Station, • Annually or as per manufacturer's instructions at Rosemead Maintenance Station.
Replacement of StreamGuard™ DII	When adsorbent material is saturated (i.e., free oil/oily water in cone) or: • after 0.5 of cumulative precipitation at Foothill Maintenance Station, • after 4 inches of cumulative precipitation at Las Flores Maintenance Station, • Annually or as per manufacturer's instructions at Rosemead Maintenance Station.
Removal of trash and debris	During monthly site inspection/maintenance visits, and once during a storm event. Collected material was sent to a laboratory for analysis to determine DII efficiency.
Vegetation/weed control	Monthly or as necessary.
Structural repairs	Within 10 working days.
Ladders or grate repair	When unsafe.
Replace markings on grate	When faded/illegible.
Removal of graffiti	Immediately.
Painting	Annually or as needed.

(1) Specific maintenance in accordance with the OMM Plan.

3.2 SUMMARY OF INSPECTION AND MAINTENANCE ACTIVITIES

The following sections describe maintenance activities performed at each DII site.

3.2.1 Fossil Filter™ DII

3.2.1.1 Foothill Maintenance Station

Removal of trash, sediment, and debris was observed in the trough on many occasions, when it was promptly removed and appropriately stored for sampling and analysis. Screen-sided stainless-steel cartridges replaced sheet-metal-sided galvanized cartridges on March 4, 1999. Other maintenance activities at this site involved replacing the adsorbent granules and cleaning of the trough and metal screens. In addition, the DII was replaced on six occasions (refer to Table 3-2 for details).

3.2.1.2 Las Flores Maintenance Station

Trash and debris were observed more frequently at this site, as was sediment, which varied from 1/8 inch to 2 inches deep on top of the cartridges on different occasions. On March 4, 1999, it was observed that sediment and asphalt accumulated in the DII. Hence, maintenance performed at the Las Flores Maintenance Station involved more frequent sediment removal, and collection of trash and debris. The screen-sided stainless-steel cartridges replaced sheet-metal-sided galvanized cartridges on March 4, 1999. Three domesticated cats are kept at Las Flores Maintenance Station, but were not observed to affect the operation of the DII. In addition, the DII was replaced twice (refer to Table 3-2 for details).

3.2.1.3 Rosemead Maintenance Station

Trash and debris on the inlet grate and/or DII were a frequent occurrence at Rosemead Maintenance Station, requiring regular removal. Sediment was removed from the top of the cartridges during visits in March, April, and May. The depth of sediment in the insert reached 2 inches on May 4, 1999, accompanied by paper, organic material, mud and an “oily-gas” odor. The Fossil Filter™ DIIs were manufactured for standard Caltrans inlets but they did not fit snugly into the standard inlets located at the Rosemead Maintenance Station. After the first two storm events, attempts were made to improve the DII's performance by supplementing the recommended manufacturer’s installation procedure. By plugging the inlet-interface gap with plastic, the minor amount of flow bypass due to the gap was eliminated. However, a better fitting DII with screen-sided stainless-steel cartridges was installed on March 4, 1999 replacing the original DII having sheet-metal sided galvanized cartridges. In addition, the DII was replaced twice (refer to Table 3-2 for details).

3.2.2 StreamGuardä DII

3.2.2.1 Foothill Maintenance Station

Occasional leaves and small amounts of sediment were observed in the DII, but not enough to warrant maintenance. Structurally, the DII covered the entire drain inlet, however, there was some concern that there could be flow bypass between insert fabric-interface, which was not always flush with the drain inlet opening. Following the second storm event, wood was inserted into the area between the insert and inlet edge to form a tight seal. In addition, the DII was replaced on five occasions (refer to Table 3-3 for details).

3.2.2.2 Las Flores Maintenance Station

Leaves and some sediment were observed in the insert, but not enough to warrant maintenance. Three domesticated cats are kept at Las Flores Maintenance Station, but were not observed to affect the operation of the drain inlet insert. In addition, the DII was replaced once (refer to Table 3-3 for details).

3.2.2.3 Rosemead Maintenance Station

Trash and debris were removed from the grate on April 8, 1999. Structurally, the DII covered the entire drain inlet, however, there was some concern that there could be flow bypass between insert fabric-interface, which was not always flush with the drain inlet opening. Following the second storm event, plywood was inserted into the area between the insert and inlet edge to form a tight seal. The StreamGuard™ was repositioned on May 4, 1999, when it was misaligned in the drain inlet opening. In addition, the DII was replaced twice (refer to Table 3-3 for details).

Table 3-2
Drain Inlet Insert Inspection Results for Fossil Filters ä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations														Comments
			Sediment	Adsorbent Color	Structurally sound	Flow	Trash/debris	Clogged	Short-circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	
Foothill Maintenance Station																	
1/23/99	1900/1940	BJB	N	W	Y	N	N	N	N	N	N	N	N	N	N	N	Newly installed monitoring station. Ready for storm water monitoring. 1st DII installed.
1/29/99	1500/1700	BJB	N	LG	Y	N	N	N	N	N	N	N	N	N	N	N	DII adsorbent and collected sediment removed and sent to laboratory for analysis (1st DII sent for analysis).
2/4/99	0915/0935	BJB	N	W	Y	N	N	N	N	N	N	N	N	N	N	N	DII adsorbent replaced in accordance with OMM Plan. 1st DII adsorbent replacement.
2/8/99	2010/2050	LRB	N	W	Y	N	N	N	N	N	N	NA	N	N	N	N	None.
2/10/99	1318/1328	EO	N	LG	Y	N	N	N	N	N	N	NA	N	N	N	N	American Sigma representative inspected monitoring equipment installation.
2/20/99	2030/2230	EO	N	LG	Y	N	N	N	N	N	N	NA	N	N	N	N	2nd DII adsorbent removed and replaced with new adsorbent (2nd DII adsorbent replacement). Adsorbent not sent to laboratory for analysis because water quality sample from 9 February 1999 storm event was not collected.

Table 3-2 (continued)
Drain Inlet Insert Inspection Results for Fossil Filters ä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations														Comments
			Sediment	Adsorbent Color	Structurally sound	Flow	Trash/debris	Clogged	Short-circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	
2/24/99	1130/1300	EO	N	W	Y	N	N	N	N	N	N	NA	N	N	N	N	DII vendor inspected site. Cartridges are galvanized and need to be replaced with stainless-steel.
3/4/99	1155/1205	BJB	N	W	Y	N	N	N	N	N	N	N	N	N	N	N	Galvanized DII cartridges replaced with stainless-steel by vendor. See photo. Per Caltrans direction, new adsorbent material replaced old (3rd DII replacement). Old adsorbent was not sent to laboratory for analysis because no water quality samples were associated with it.
3/24/99	0830/1000	EO	N	W	Y	N	N	N	N	N	N	N	N	N	N	N	Caltrans restarts storm event sampling activities in addition to empirical observations. Per Caltrans direction, new adsorbent material replaced old (4th DII adsorbent replacement). Old adsorbent was not sent to laboratory for analysis because no water quality samples were associated with it.

Table 3-2 (continued)
Drain Inlet Insert Inspection Results for Fossil Filters ä
1998/99 Storm Water Monitoring Season

			General DII Observations														
Date	**Time in/out**	**Team leader's initials (1)**	**Sediment**	**Adsorbent Color**	**Structurally sound**	**Flow**	**Trash/debris**	**Clogged**	**Short-circuiting**	**Resuspension**	**Odors**	**Vegetation**	**Animals**	**Structural**	**Aesthetic**	**Other**	**Comments**
3/29/99	0630/0940	BJB	Y	W/ LG	Y	N	Y	N	N	N	N	NA	N	N	N	N	Leaves, gum, paper and <1/8 inch sediment in DII, which will be cleaned out before next storm event.
4/8/99	0730/0800	BJB	N	W	Y	N	N	N	N	N	N	N	N	N	N	N	5th DII adsorbent removed and replaced with new adsorbent (5th DII adsorbent replacement). DII adsorbent and collected sediment removed and sent to laboratory for analysis (2nd DII sent for analysis).
4/12/99	0900/1000	EO	N	W	Y	N	N	N	N	N	N	N	N	N	N	N	6th DII adsorbent removed and replaced with new adsorbent (6th DII adsorbent replacement). DII adsorbent and collected sediment removed and sent to laboratory for analysis (3rd DII sent for analysis).
4/19/99	1000/1130	BJB	N	W	Y	N	N	N	N	N	N	NA	N	N	N	N	None
Las Flores Maintenance Station																	
1/23/99	1215/1245	BJB	Y	W	Y	N	N	N	N	N	N	N	Y	N	N	N	Inspection of 1st DII. Sediment (0.5 inch approximate depth) not expected to interfere with operation. Three cats observed.

Table 3-2 (continued)
Drain Inlet Insert Inspection Results for Fossil Filters ä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations															Comments
			Sediment	Adsorbent Color	Structurally sound	Flow	Trash/debris	Clogged	Short-circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other		
1/28/99	0852/0924	BJB	Y	LG	Y	N	N	N	N	N	N	N	Y	N	Y	N		Three cups on inlet grate. Three cats observed.
1/30/99	1700/2000	LRB	N	W	Y	N	Y	N	N	N	N	NA	N	N	Y	N		Leaves, paper, wrappers, etc. filtered (stuck in granules and frame). Appears to be operating fine.
2/4/99	1410/1415	BJB	N	LG	Y	N	N	N	N	N	N	N	N	N	N	N		0.25 – 0.5 inch of sediment covered 80% of adsorbent granules.
2/9/99	0335/0420	LRB	Y	LG	Y	N	Y	N	N	N	N	NA	N	N	Y	N		A small amount of leaves are trapped by the DII.
2/24/99	1530/1900	EO	Y	LG	Y	N	Y	Y	Y	N	N	N	N	N	Y	Y		DII vendor inspected site. Cartridges are galvanized and need to be replaced with stainless-steel. A dry weather flow test was performed using a nearby hose. Bypass occurred due to clogging of filter cartridge. Sediment and debris was removed and test was re-run. No bypass occurred when cartridge was free of sediment and debris

Table 3-2 (continued)
Drain Inlet Insert Inspection Results for Fossil Filters ä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations														Comments
			Sediment	Adsorbent Color	Structurally sound	Flow	Trash/debris	Clogged	Short-circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	
3/4/99	1400/1420	BJB	Y	LG	Y	N	Y	Y	Y	N	N	N	N	N	N	N	Sediment (1 inch depth) and asphalt appear to have been hosed in from surrounding area. Galvanized DII cartridges replaced with stainless-steel by vendor. Per Caltrans direction, new adsorbent material replaced old (1st DII replacement). Old adsorbent was not sent to laboratory for analysis.
3/19/99	1030/1040	BJB	Y	LG	Y	N	Y	Y	N	N	N	NA	Y	N	N	N	Sediment (1/8 inch depth covering 40% area) and debris must be removed from DII before next storm event.
3/24/99	1500/1900	EO	N	W	Y	N	N	N	N	N	N	N	N	N	N	N	Caltrans restarts storm event sampling activities in addition to empirical observations. Per Caltrans direction, new adsorbent material replaced old (2nd DII adsorbent replacement). Old adsorbent was not sent to laboratory for analysis because no water quality samples were associated with it.
3/31/99	0750/1000	BJB	N	W/LG	Y	N	N	N	N	N	N	N	N	N	N	N	None.

Table 3-2 (continued)
Drain Inlet Insert Inspection Results for Fossil Filters ä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	Sediment	Adsorbent Color	Structurally sound	Flow	Trash/debris	Clogged	Short-circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	Comments
			General DII Observations														
4/8/99	1530/1630	BJB	Y	LG	Y	N	Y	N	N	N	N	NA	N	N	N	N	Sediment (3/4 inch)/asphalt/cigarette butts must be removed and placed in storage container. Trough will be cleaned out prior to next storm event.
4/20/99	0700/0800	BJB	N	LG	Y	N	Y	N	N	N	N	N	Y	N	N	N	Debris (leaves, pieces of asphalt) must be removed from inlet prior to next storm event. Three cats observed.
5/17/99	1320/1410	SA	Y	LG	Y	N	Y	N	N	Y	N	N	N	N	N	Y	Sediment build-up (approximately 2 inches) in DII. DII must be cleaned out prior to next storm event.
Rosemead Maintenance Station																	
1/23/99	1535/1601	BJB	Y	W	Y	N	N	N	N	N	N	N	N	N	N	N	Inspection of 1st DII. Small areas of sediment/debris, 10%-20% coverage of granules (by area). Ready for monitoring.
1/30/99	2200/0100	LRB	N	W	Y	N	Y	N	N	N	N	N	N	N	Y	N	Small amount of leaves and paper.
2/4/99	1225/1233	BJB	Y	W	Y	N	Y	Y	N	N	N	N	N	N	Y	N	Removed trash and debris from DII and inlet grate.
2/8/99	2125/2215	LRB	N	LG	Y	N	Y	N	N	N	N	N	N	N	Y	N	Paper trash and leaves in DII. Not enough to warrant maintenance.

Table 3-2 (continued)
Drain Inlet Insert Inspection Results for Fossil Filters ä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations														Comments
			Sediment	Adsorbent Color	Structurally sound	Flow	Trash/debris	Clogged	Short-circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	
2/10/99	1545/1600	EO	Y	LG	Y	Y	N	N	N	N	N	NA	N	N	N	N	Trickle is from a hose used at the maintenance station. American Sigma inspected monitoring equipment.
2/21/99	0030/0130	EO	Y	LG	Y	N	Y	N	N	N	N	NA	N	N	Y	Y	Removed trash and debris from DII and inlet grate. Gap between DII and drain inlet wall was filled with foam material to prevent bypass.
2/24/99	0900/1030	EO	N	LG	Y	N	Y	N	N	N	N	NA	N	N	N	N	DII vendor inspected site. Cartridges are galvanized and need to be replaced with stainless-steel. Also, a gap exists between the DII and the drain inlet. Vendor to provide a better fitting unit.
3/4/99	0841/0900	BJB	N	W	Y	N	N	N	N	N	N	N	N	N	N	N	A better fitting DII with stainless-steel cartridges was installed by vendor. Per Caltrans direction, new adsorbent material replaced old (1st DII replacement). Old adsorbent was not sent to laboratory for analysis. See photo.

Table 3-2 (continued)
Drain Inlet Insert Inspection Results for Fossil Filters ä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations														Comments
			Sediment	Adsorbent Color	Structurally sound	Flow	Trash/debris	Clogged	Short-circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	
3/9/99	1045/1330	EO	Y	W	Y	Y	Y	Y	Y	Y	N	N	N	N	N	Y	A dry weather flow test was performed using a nearby hose. Light rain also occurred. Bypass occurred due to clogging of filter cartridge. Sediment and debris was removed and test was re-run. Bypass was minimized when cartridge was free of sediment and debris.
3/24/99	1030/1230	EO	N	W	Y	N	N	N	N	N	N	N	N	N	N	N	Caltrans restarts storm event sampling activities in addition to empirical observations. Per Caltrans direction, new adsorbent material replaced old (2nd DII adsorbent replacement). Old adsorbent was not sent to laboratory for analysis because no water quality samples were associated with it.
3/29/99	1200/1445	BJB	Y	W/LG	Y	N	Y	Y	N	Y	N	NA	N	N	N	N	Sediment (1/8 - 1/2 inch depth)/trash/debris removed per Caltrans guidance.
4/8/99	1240/1320	BJB	Y	W/LG	Y	N	Y	N	N	N	N	N	N	N	N	N	Need to remove sediment (1/4 inch depth with 50% coverage) from DII prior to next storm event.

Table 3-2 (continued)
Drain Inlet Insert Inspection Results for Fossil Filters ä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations														Comments
			Sediment	Adsorbent Color	Structurally sound	Flow	Trash/debris	Clogged	Short-circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	
4/12/99	1100/1200	EO	N	LG	Y	N	N	N	N	N	N	N	N	N	N	N	None.
4/19/99	1300/1400	BJB	Y	LG	Y	N	Y	Y	Y	Y	N	NA	N	N	N	N	Trough completely blocked by paper and plastic trash, and by 1/2 inch sediment. DII must be cleaned prior to next storm event.
5/4/99	1000/1030	SA	Y	LG	Y	N	Y	Y	Y	Y	Y	N	N	N	Y	N	Paper, dried organic material, mud, and 2 inch depth sediment in DII. Oily-gas odor. Must be cleaned prior to next storm event.
5/17/99	1050/1140	SA	N	LG	Y	N	Y	Y	N	Y	NM	NM	N	N	Y	N	Dried organic material and paper around grate. Dried organic material and soil in DII.

Notes:
4. Team members are from LAWCRANDALL W = White LG = Light Gray N = No Y = Yes NA = Not applicable NM = Not marked on field form.

Table 3-3
Drain Inlet Insert Inspection Results for StreamGuardä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations: Sediment	Liquid	Rips/tears	Flow	Trash/debris	Clogged	Short circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	Comments
Foothill Maintenance Station																	
1/23/99	2030/2058	BJB	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Newly installed monitoring station. Ready for storm water monitoring. 1st DII installed.
1/29/99	1500/1700	BJB	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	DII and collected sediment removed and sent to laboratory for analysis (1st DII sent for analysis).
1/30/99	1200/1430	LRB	NS	NS	NS	NS	Y	NS	NS	NS	N	NA	N	N	Y	N	Insert not installed
2/4/99	1030/1045	BJB	N	N	N	N	N	N	N	N	N	N	N	N	N	N	DII replaced in accordance with OMM Plan. 1st DII replacement.
2/8/99	1910/2000	LRB	N	N	N	N	N	N	N	N	N	NA	N	N	N	N	DII appears to be brand new.
2/10/99	1350/1359	EO	N	N	N	N	N	N	N	N	N	NA	N	N	N	N	American Sigma representative inspected monitoring equipment installation.

Table 3-3 (continued)
Drain Inlet Insert Inspection Results for StreamGuardä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations: Sediment	Liquid	Rips/tears	Flow	Trash/debris	Clogged	Short circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	Comments
2/20/99	2030/2230	EO	N	N	N	N	N	N	N	N	N	NA	N	N	N	N	2nd DII removed and replaced with new DII (2nd DII replacement). DII not sent to the laboratory for analysis because water quality samples for the 9 February 1999 storm event were not collected. For the new DII, wood was used to press the DII against the drain inlet wall to minimize flow bypass.
2/24/99	1130/1300	EO	N	N	N	N	N	N	N	N	N	NA	N	N	N	N	None.
3/4/99	1205/1215	BJB	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	A few leaves in the DII.
3/24/99	0830/1000	EO	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	Caltrans restarts storm event sampling activities. Per Caltrans direction, a new DII is installed (3rd DII replacement). Old DII was not sent to the laboratory for analysis because no water quality samples were associated with it.

Table 3-3 (continued)
Drain Inlet Insert Inspection Results for StreamGuardä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations														Comments
			Sediment	Liquid	Rips/tears	Flow	Trash/debris	Clogged	Short circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	
3/29/99	0940/1130	BJB	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Leaves and sticks in DII. Ready for storm water monitoring.
4/8/99	1000/1030	BJB	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	4^{th} DII replaced with new DII (4^{th} DII replacement). DII and collected sediment removed and sent to laboratory for analysis (2^{nd} DII sent for analysis).
4/12/99	0900/1000	EO	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5^{th} DII replaced with new DII (5^{th} DII replacement). DII and collected sediment removed and sent to laboratory for analysis (3^{rd} DII sent for analysis).
4/19/99	1130/1230	BJB	N	N	N	N	N	N	N	N	N	NA	N	N	N	N	None.
Las Flores Maintenance Station																	
1/23/99	1000/1027	BJB	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Newly installed DII in good condition. 1^{st} DII installed. Ready for storm water monitoring. Three cats observed.

Table 3-3 (continued)
Drain Inlet Insert Inspection Results for StreamGuard™
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations: Sediment	Liquid	Rips/tears	Flow	Trash/debris	Clogged	Short circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	Comments
1/28/99	0950/1000	BJB	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Three cats observed.
1/30/99	1700/2000	LRB	NS	NS	NS	NS	NS	NS	NS	NS	NS	NA	N	N	NS	NS	Three cats observed; prepared monitoring equipment for forecasted storm but didn't make observations at DII.
2/4/99	1435/1445	BJB	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	None.
2/9/99	0425/0430	LRB	N	N	N	N	Y	N	N	N	N	N	N	N	Y	N	DII skirt has leaves trapped; cone is densely covered with leaves. Water can still pass but maintenance will be required soon.
2/24/99	1530/1900	EO	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	Three cats observed onsite.
3/4/99	1500/1520	BJB	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	A few leaves in DII.
3/19/99	1115/1125	BJB	Y	N	N	N	Y	N	N	N	N	NA	Y	N	N	N	Cone about half filled with leaves.

Table 3-3 (continued)
Drain Inlet Insert Inspection Results for StreamGuardä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations														Comments
			Sediment	Liquid	Rips/tears	Flow	Trash/debris	Clogged	Short circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	
3/24/99	1500/1900	EO	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	Caltrans restarts storm event sampling activities. Per Caltrans direction, a new DII is installed (1st DII replacement). Old DII was not sent to the laboratory for analysis because no water quality samples were associated with it.
3/31/99	1000/1200	BJB	Y	N	N	N	Y	N	N	N	N	N	Y	N	N	N	Three small cats observed. A few leaves in DII.
4/8/99	1430/1530	BJB	Y	N	N	N	Y	N	N	N	N	NA	N	N	N	N	Dried organic material in DII.
4/20/99	0800/0900	BJB	Y	N	N	N	Y	N	N	N	N	NA	Y	N	N	N	Three domesticated cats observed. Leaves in DII.
Rosemead Maintenance Station																	
1/23/99	1715/1740	BJB	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Newly installed maintenance station. 1st DII installed. Ready for storm water monitoring.

Table 3-3 (continued)
Drain Inlet Insert Inspection Results for StreamGuardä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations: Sediment	Liquid	Rips/tears	Flow	Trash/debris	Clogged	Short circuiting	Resuspension	Odors	Vegetation	Animals	Structural	Aesthetic	Other	Comments
1/30/99	2200/0100	LRB	N	N	N	N	Y	N	N	N	N	NA	N	N	Y	N	Various leaves and paper "clinging" to DII material.
2/4/99	1205/1210	BJB	N	N	N	N	N	N	N	N	N	N	N	N	N	N	None.
2/8/99	2220/2305	LRB	N	N	N	N	Y	N	N	N	N	NA	N	N	Y	N	Debris and leaves trapped by skirt and cone. Not enough to warrant maintenance.
2/10/99	1512/1530	EO	Y	N	N	N	N	N	N	N	N	NA	N	N	N	N	None.
2/21/99	0030/0130	EO	Y	N	N	N	N	N	N	N	N	NA	N	N	N	N	1st DII removed and replaced with new DII (1st DII replacement). DII not sent to the laboratory for analysis because water quality samples for the 9 February 1999 storm event were not collected. For the new DII, wood was used to press the DII against the drain inlet wall to minimize flow bypass.
2/24/99	0900/10/30	EO	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	None.

Table 3-3 (continued)
Drain Inlet Insert Inspection Results for StreamGuardä
1998/99 Storm Water Monitoring Season

Date	Time in/out	Team leader's initials (1)	General DII Observations														Comments
			Sediment	Liquid	Rips/tears	Flow	Trash/debris	Clogged	Short circuiting	Resuspensio n	Odors	Vegetation	Animals	Structural	Aesthetic	Other	
3/4/99	0940/1000	BJB	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	There are four leaves in the cone of the DII.
3/9/99	1045/1330	EO	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	Light rain occurred at the site. DII was removed from drain inlet. DII was not sent to the laboratory for analysis.
3/24/99	1030/1230	EO	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	Caltrans restarts storm event sampling activities. Per Caltrans direction, a new DII is installed (2nd DII replacement).
3/29/99	1445/1500	BJB	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	None.
4/8/99	1200/1240	BJB	Y	Y	N	N	Y	N	N	Y	N	N	N	N	Y	N	Trash and debris need to be removed from grate prior to next storm event.
4/19/99	1400/1500	BJB	Y	N	N	N	N	N	N	N	N	NA	N	N	N	N	None.
5/4/99	0914/1000	SA	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	DII not in place, repositioned. Accumulated sediment almost at maintenance threshold of 6 inches.

Table 3-3 (continued)
Drain Inlet Insert Inspection Results for StreamGuard™
1998/99 Storm Water Monitoring Season

Notes:

1. Team members are from LAWCRANDALL N = No Y = Yes NA = Not applicable NS = DI insert not seen at site or observations not made.

Table 3-4
Maintenance Activities at Drain Inlet Inserts: Fossil Filterä
During the 1998/99 Storm Water Monitoring Season

Date	Team Leader's Initials (1)	Maintenance Task Performed	Time Required for Task (Minutes)	During Storm Event?	Comments
Foothill Maintenance Station					
1/29/99	BJB	DII adsorbent and collected sediment removed and sent to laboratory for analysis (1st DII sent for analysis).	30	N	None.
2/4/99	BJB	DII adsorbent replaced in accordance with OMM Plan. 1st DII replacement.	20	N	None.
2/20/99	EO	2nd DII adsorbent removed and replaced with new adsorbent (2nd DII adsorbent replacement). Adsorbent not sent to laboratory for analysis because water quality sample from 9 February 1999 storm event was not collected.	60	N	None.
3/4/99	BJB	Replacement of DII cartridges by Fossil Filter™ personnel (3rd DII replacement).	20	N	Stainless steel cartridges replaced galvanized steel cartridges.
3/24/99	EO	Caltrans restarts storm event sampling activities in addition to empirical observations. Per Caltrans direction, new adsorbent material replaced old (4th DII adsorbent replacement). Old adsorbent was not sent to laboratory for analysis because no water quality samples were associated with it.	60	N	None.

Table 3-4 (continued)
Maintenance Activities at Drain Inlet Inserts: Fossil Filters ä
During the 1998/99 Storm Water Monitoring Season

Date	Team Leader's Initials (1)	Maintenance Task Performed	Time Required for Task (Minutes)	During Storm Event?	Comments
3/29/99	BJB	Removal and proper storage of trash, debris, and sediment from trough.	25	N	Ready for storm water monitoring.
4/8/99	BJB	5th DII adsorbent removed and replaced with new adsorbent (5th DII adsorbent replacement). DII adsorbent and collected sediment removed and sent to laboratory for analysis (2nd DII sent for analysis).	70	N	None.
4/12/99	EO	6th DII adsorbent removed and replaced with new adsorbent (6th DII adsorbent replacement). DII adsorbent and collected sediment removed and sent to laboratory for analysis (3rd DII sent for analysis).	60	N	None.
Las Flores Maintenance Station					
1/29/99	BJB	Debris and trash removal.	2	N	None.
2/24/99	EO	DII vendor inspected site. Cartridges are galvanized and need to be replaced with stainless-steel. A dry weather flow test was performed using a nearby hose. Bypass occurred due to clogging of filter cartridge. Sediment and debris was removed and test was re-run. No bypass occurred when cartridge was free of sediment and debris	45	N	None.

Table 3-4 (continued)
Maintenance Activities at Drain Inlet Inserts: Fossil Filters ä
During the 1998/99 Storm Water Monitoring Season

Date	Team Leader's Initials (1)	Maintenance Task Performed	Time Required for Task (Minutes)	During Storm Event?	Comments
3/4/99	BJB	Sediment (1 inch depth) and asphalt appear to have been hosed in from surrounding area. Galvanized DII cartridges replaced with stainless-steel by vendor. Per Caltrans direction, new adsorbent material replaced old (1st DII replacement). Old adsorbent was not sent to laboratory for analysis.	15	N	Stainless-steel cartridges replaced galvanized metal.
3/19/99	BJB	Removal of sediment and leaves from trough.	10	Y	None.
3/24/99	EO	Caltrans restarts storm event sampling activities in addition to empirical observations. Per Caltrans direction, new adsorbent material replaced old (2nd DII adsorbent replacement). Old adsorbent was not sent to laboratory for analysis because no water quality samples were associated with it.	60	N	None.
4/8/99	BJB	Removal and proper storage of sediment from trough.	15	N	None
4/20/99	BJB	Removal of sediment from trough.	10	N	Ready for monitoring.
5/17/99	SA	Removal of sediment from silt basin.	40	N	None.
Rosemead Maintenance Station					

Table 3-4 (continued)
Maintenance Activities at Drain Inlet Inserts: Fossil Filters ä
During the 1998/99 Storm Water Monitoring Season

Date	Team Leader's Initials (1)	Maintenance Task Performed	Time Required for Task (Minutes)	During Storm Event?	Comments
2/4/99	BJB	Debris and trash removal.	4	N	Leaves, paper and cups removed.
2/21/99	EO	Removed trash and debris from DII and inlet grate. Gap between DII and drain inlet wall was filled with foam material to prevent bypass.	60	N	None.
3/4/99	BJB	Replacement of Fossil Filter cartridges.	25	N	Stainless-steel cartridges replaced galvanized metal.
3/9/99	EO	Sediment and debris was removed from the DII.	10	Y	A dry weather flow test was performed using a nearby hose. Light rain also occurred. Bypass occurred due to clogging of filter cartridge..
3/24/99	EO	Caltrans restarts storm event sampling activities in addition to empirical observations. Per Caltrans direction, new adsorbent material replaced old (2nd DII replacement). Old adsorbent was not sent to laboratory for analysis because no water quality samples were associated with it.	60	N	None.
3/29/99	BJB	Removal of sediment from trough.	10	N	Removed per Caltrans. Ready for monitoring.
4/8/99	BJB	Removal and proper storage of sediment from trough.	15	N	None.

Table 3-4 (continued)
Maintenance Activities at Drain Inlet Inserts: Fossil Filters ä
During the 1998/99 Storm Water Monitoring Season

Date	Team Leader's Initials [1]	Maintenance Task Performed	Time Required for Task (Minutes)	During Storm Event?	Comments
4/19/99	BJB	Removal and proper storage of sediment from trough.	20	N	Ready for monitoring.
5/4/99	SA	Removal of trash , debris, and sediment from trough.	30	N	None
5/17/99	SA	Debris and trash removal.	30	N	None.

Notes:
1. Team members are from LAWCRANDALL

Table 3-5
Maintenance Activities at Drain Inlet Inserts: StreamGuard™
During the 1998/99 Storm Water Monitoring Season

Date	Team Leader's Initials (1)	Maintenance Task Performed	Time Required For Task (Minutes)	During Storm Event?	Comments
Foothill Maintenance Station					
1/29/99	BJB	DII and collected sediment removed and sent to laboratory for analysis (1st DII sent for analysis).	45	N	None.
2/4/99	BJB	DII replaced in accordance with OMM Plan. 1st replacement.	40	N	None.
2/20/99	EO	2nd DII removed and replaced with new DII (2nd DII replacement). DII not sent to the laboratory for analysis because water quality samples for the 9 February 1999 storm event were not collected.	90	N	For the new DII, wood was used to press the DII against the drain inlet wall to minimize flow bypass.
3/24/99	EO	Caltrans restarts storm event sampling activities. Per Caltrans direction, a new DII is installed (3rd DII replacement). Old DII was not sent to the laboratory for analysis because no water quality samples were associated with it.	60	N	None.

Table 3-5 (Continued)
Maintenance Activities at Drain Inlet Inserts: StreamGuard™
During the 1998/99 Storm Water Monitoring Season

Date	Team Leader's Initials (1)	Maintenance Task Performed	Time Required For Task (Minutes)	During Storm Event?	Comments
4/8/99	BJB	4th DII replaced with new DII (4th DII replacement). DII and collected sediment removed and sent to laboratory for analysis (2nd DII sent for analysis).	40	N	Replaced per OMM Plan.
Las Flores Maintenance Station					
3/24/99	EO	Caltrans restarts storm event sampling activities. Per Caltrans direction, a new DII is installed (1st DII replacement). Old DII was not sent to the laboratory for analysis because no water quality	45	N	None.
Rosemead Maintenance Station					
2/21/99	EO	1st DII removed and replaced with new DII (1st DII replacement). DII not sent to the laboratory for analysis because water quality samples for the 9 February 1999 storm event were not collected.	90	N	For the new DII, wood was used to press the DII against the drain inlet wall to minimize flow bypass.

Table 3-5 (Continued)
Maintenance Activities at Drain Inlet Inserts: StreamGuard™
During the 1998/99 Storm Water Monitoring Season

Date	Team Leader's Initials (1)	Maintenance Task Performed	Time Required For Task (Minutes)	During Storm Event?	Comments
3/9/99	EO	DII was removed from drain inlet. DII was not sent to the laboratory for analysis.	30	N	Light rain occurred at the site.
3/24/99	EO	Caltrans restarts storm event sampling activities. Per Caltrans direction, a new DII is installed (2nd DII replacement).	60	N	None.
4/8/99	BJB	Removal of trash and debris from grate.	5	N	None.
5/4/99	SA	Repositioning of StreamGuard.	20	N	None.

Notes:
1. Team members are from LAWCRANDALL

4.0 DESIGN AND CONSTRUCTION EVALUATION

4.1 FOSSIL FILTER™ DRAIN INLET

One structural reason for bypass was that the Fossil Filters™ fitted poorly into the drain inlets. The Fossil Filters™ were manufactured for standard Caltrans inlets but they did not fit snugly into the standard inlets located at the maintenance stations. Although the edges of the inserts included rubber linings to press against the inlet edge and eliminate any open space, the rubber lining did not completely eliminate the gap. This was particularly noticeable at the inlet at Rosemead Maintenance Station, where there was a gap of approximately 0.10 inch between the insert and inlet edge. Similar flow bypass, due to imperfect insert-inlet fit, was also observed at Las Flores and Rosemead Maintenance Stations.

After the first two monitored storm events of the BMP Retrofit Pilot Program, manufacturer's installation procedure were supplemented at Rosemead Maintenance Station. The minor amount of flow bypass due to the gap was eliminated by plugging the inlet-interface gap with foam material. However, when a better-fitting replacement DII was installed on 4 March 1999, it was decided to install the DIIs per the manufacturer's recommendations and that no additional installation work would be done. Consequently the new Fossil Filter™ at Rosemead Maintenance Station had an inlet-interface gap of approximately 0.05 inch and a minor amount of flow bypass due to the gap was subsequently observed.

A second structural reason that allowed bypass at Rosemead Maintenance Station was that the Fossil Filter™ did not fit well in the curb inlet. The corners where the insert meets the cut-out section of curb allowed flow bypass with as little as 0.01 inch of precipitation.

Hydraulic capacity was another factor that limited Fossil Filter™ performance. The Fossil Filter™ DIIs are designed to not impede flows (due to flood control considerations) they become ineffective at higher discharge rates. During higher discharge rates, runoff had sufficient velocity to pass over the lip of the cartridges and go directly into the storm drain system. This was observed at Foothill Maintenance Station on March 15, 1999. Discharge from the drainage area, measured at 0.15 cfs (67 gpm) resulted in significant flow bypass.

The third factor that caused flow bypass was blockage and clogging of the DII. Blockage occurred from the accumulation of trash, debris, and sediment on top of the cartridge screens. This accumulation blocked the cartridge screens so that stormwater runoff could not pass through the screens. The resultant standing water pooled and eventually achieved a depth where it spilled over the cartridge lip into the storm drain. Clogging occurred when sediment passed through the cartridge screens and settled in the pore spaces between the adsorbent granules. This appeared to cause a slowing in the infiltration of water through the adsorbent. Water pooled and reached a depth where it spilled over the cartridge lip into the storm drain.

4.2 STREAMGUARDä DRAIN INLET

Structurally, the StreamGuard™ covered the entire drain inlet. There was some concern that there could be flow bypass between insert fabric-interface, which was not always flush against the drain inlet opening. To address the concern, at Foothill and Rosemead Maintenance Stations, where the geometry of the inlet grates were more susceptible to an inlet-insert gap, wood was inserted into the area between the insert and inlet edge to form a tight seal.

Hydraulic capacity problems of the StreamGuard™ were not observed. Even during peak flows there no bypass was observed. The cone of the DII is 24 inches in depth. When standing water in the cone reaches a depth of approximately 22 inches, bypass can occur through two openings in the side. However, the deepest standing water observed in the insert cone was 12 inches at Foothill Maintenance Station - during the same storm that caused severe flow bypass at the Fossil Filter™ at Foothill Maintenance Station
.

Blockage and clogging were not observed because of the design of the StreamGuard™. The entire insert is constructed of a permeable geotextile fabric. Therefore, if trash, debris and/or sediment accumulate in the bottom, runoff can still filter through the sides of the cone.

5.0 COST SUMMARY

A cost summary for maintenance of the BMPs during the 1998/99 wet season is currently being prepared and will be provided by July 15, 1999.

APPENDIX C:

DISTRICT 11 FIRST YEAR 1998-1999 MONITORING REPORT

CALTRANS
BMP RETROFIT PILOT PROGRAM

DISTRICT 11, SAN DIEGO

FIRST YEAR 1998-1999 REPORT

BEST MANAGEMENT PRACTICES

OPERATIONS, MONITORING & MAINTENANCE

June 1999

First Year 1998-1999 Report

1.0 STORM WATER DATA

Monitoring of the District 11 Retrofit Pilot BMPs began immediately after installation of the storm water monitoring equipment. Equipment installations were completed on 25 January 1999 at the State Route 78/I15 and State Route 56/I5 extended detention basins. Equipment installations were completed on or around 24 March 1999 for the media filters at the Kearny Mesa Maintenance Station, Escondido Maintenance Station, La Costa Avenue Park and Ride, and the State Route 78/I5 Park and Ride. Because of the short period of time between the installation of the equipment and the onset of rain, flow verification of the flow monitoring equipment was unable to be performed prior to monitored events. Installation of monitoring equipment at the Carlsbad Maintenance Station infiltration trench and Melrose Avenue biofiltration swale was also completed towards the end of March. However, these sites were not sampled because of the lack of established vegetation at the BMPs.

Five rainfall events were monitored for two to five BMPs during the 1998/1999 season. These rainfall events occurred on 25 January, 4 February, 25 March, 6 and 7 April, and 11 and 12 April 1999.

1.1 Hydrology

1.1.1 Precipitation During the 1998/1999 Water Year

The 1998-1999 water year was a relatively dry year in San Diego County (Figure 1.1). A total of 6.64” inches of rain was recorded in the City of Escondido in northern San Diego County between 1 October 1997 and 30 April 1999. Similar precipitation amounts (6.87 inches) were recorded in mid-county at the Del Mar Fire Station for the same period. Normal precipitation in San Diego County is around 9.5 inches per year.

January followed by April 1999 were the wettest months of the water year. These two months accounted for more than half the season’s total precipitation. October and February were the driest months of the water year.

Figure 1.2 illustrates cumulative rainfall for the 1998-1999 water year at the 6 BMP sites activated this past season for monitoring. The Kearny Mesa Maintenance Station followed closely by the La Costa Avenue Park and Ride had the most rainfall (7.50 and 7.38 inches, respectively). The State Route 78 and I5 Park and Ride recorded the least amount of rain with 5.43 inches of precipitation through 24 May 1999. Rainfall data at the BMP sites were supplemented with the nearest alternate rain gage data for the period prior to the activation of the monitoring equipment. In the case of the State Route 56 and I5 extended detention basin alternative rain gage data were also used when the gage malfunctioned. The name and location of the alternate rain gages along with their corresponding BMP sites are shown in Table 1.1.

Table 1.1. Name and Location of Rain Gages Used to Supplement Rainfall Data at the BMP Sites.

Site	Alternate Rain Gage	Location	
		Latitude	Longitude
SR78 and I15	Escondido (ESCC1)	33° 07’ 22”	117° 05’ 18”
SR56 and I5	Del Mar Fire Station (DMRC1)	32° 58’	117° 16’
Kearny Mesa Maintenance Station	Montgomery Field (MYF)	33° 22’	117° 13’
La Costa Ave. Park and Ride	Carlsbad	33° 07’ 47”	117° 16’ 36”
Escondido Maintenance Station	Escondido (ESCC1)	33° 07’ 22”	117° 05’ 18”
SR78 and I5 Park and Ride	Oceanside (L34)	33° 12’	117° 23’

1.1.2 Precipitation During Monitored Events

Precipitation during each storm event was characterized by total rainfall, duration of rainfall, maximum intensity, days since last rainfall, and the magnitude of the event immediately preceding the monitored storm event (antecedent rainfall). Precipitation characteristics for each event are summarized in Table 1.2. Cumulative rainfall is summarized graphically for each monitored event at each BMP site in Figures 1.3 through 1.22.

A variety of storm conditions were monitored at most sites from January through April 1999. Except at the La Costa Avenue Park and Ride during the 4th event and Escondido Maintenance Station during the 5th event, all storm events monitored were spaced by at least 3 days. The two aforementioned station events were preceded by rainfall 2.7 days earlier. The 10 days preceding the third event on 25 March 1999 was the driest period prior to a monitored event.

Event 1 on 25 January 1999 had the most rainfall with 1.22 inches at Escondido and 0.92 inches at the Del Mar Fire Station. The fourth event on 6 and 7 April had, for the most part, the least amount of rainfall with rainfall totals ranging from 0.16 inches at the La Costa Avenue Park and Ride to 0.61 inches at the State Route 78 and I15 extended detention basin. Event 4 also had the most variability in rainfall among stations.

Where data are available, rainfall intensities (inches per hour over a 15-minute period) were fairly light during most monitored events. For the most part, maximum intensities were around 0.25 inches of rain per hour. The most intense rain (0.84 inches per hour) fell on the State Route 56 and I5 extended detention basin during Event 3 on 25 March 1999. However, hydrology data suggests that even more intense rain fell during

Table 1.2 Rainfall and runoff statistics for each monitored event.

Site/Event	Start Rain Date	Start Rain Time	End Rain Date	End Rain Time	Duration Rain (hours:minutes)	Total Rain (inches)	Max Intensity (Inches/hour)	Antecedent Rain (days)	Antecedent Rain (inches)
Event 1									
SR78/I15-IN **SR78/I15-EFF**	1/25/99	3:00	01/25/99	18:20	15:20:00	1.22[1]	NA	3.8	0.12
SR56/I5-IN **SR56/I5-EFF**	01/25/99	NA	01/25/99	NA	NA	0.92[2]	NA	4.0	0.3
Event 2									
SR78/I15-IN **SR78/I15-EFF**	2/4/99	15:00	2/5/99	5:30	14:30:00	0.39	0.20	3.75	0.16
SR56/I5-IN **SR56/I5-EFF**	2/4/99	6:00	2/5/99	11:15	29:15:00	0.48	0.28	4.0	0.12
Event 3									
SR78/I15-IN **SR78/I15-EFF**	3/25/99	13:00	3/25/99	18:30	5:30:00	0.36	0.28	10.0	0.25
SR56/I5-IN **SR56/I5-EFF**	3/25/99	13:00	3/25/99	18:38	5:38:00	0.66	0.84	10.0	0.20
KEARNYMS-IN **KEARNYMS-EFF**	3/25/99	13:09	3/25/99	19:15	6:06:00	0.62	0.40	9.3	0.23
ESCONMS-IN **ESCONMS-EFF**	3/25/99	13:00	3/25/99	18:45	5:45:00	0.29	0.16	10.1	0.22
LACOSTAP&R-IN **LACOSTAP&R-EFF**	3/25/99	12:30	3/25/99	18:45	6:15:00	0.54	0.32	10.1	0.20
SR78/I5P&R-IN **SR78/I5P&R-EFF**	3/25/99	12:30	3/25/99	18:30	6:00:00	0.68	0.36	10.0	0.25
Event 4									
SR78/I15-IN **SR78/I15-EFF**	4/7/99	2:45	4/7/99	10:13	7:28:00	0.61	0.36	3.1	0.19
SR56/I5-IN **SR56/I5-EFF**	4/6/99	NA	4/7/99	NA	NA	0.26[2]	NA	4.7	0.49
KEARNYMS-IN **KEARNYMS-EFF**	4/6/99	17:15	4/7/99	9:45	16:30:00	0.23	0.16	4.9	0.37
ESCONMS-IN **ESCONMS-EFF**	4/6/99	17:00	4/7/99	6:30	13:30:00	0.39	0.24	6.0	0.51
LACOSTAP&R-IN **LACOSTAP&R-EFF**	4/6/99	17:00	4/7/99	9:30	16:30:00	0.16	0.08	2.7	0.2
Event 5									
SR56/I5-IN **SR56/I5-EFF**	4/11/99	NA	4/13/99	NA	NA	0.86[2]	NA	3.0	0.3
KEARNYMS-IN **KEARNYMS-EFF**	4/11/99	16:42	4/12/99	12:00	19:18:00	0.78	0.28	4.3	0.23
ESCONMS-IN **ESCONMS-EFF**	4/11/99	17:00	4/12/99	1:32	8:32:00	0.57	0.20	2.7	0.10
LACOSTAP&R-IN **LACOSTAP&R-EFF**	4/11/99	16:00	4/12/99	5:15	13:15:00	0.81	0.24	4.3	0.16
SR78/I5P&R-IN **SR78/I5P&R-EFF**	4/11/99	15:55	4/12/99 0:00	2:00	10:05:00	0.81	0.28	4.3	0.12

1 = Rainfall data from Escondido (32^{o} 07' 22" Latitude, 117^{o} 05' 18" Longitude)
2 = Rainfall data from the Del Mar Fire Station near San Diequito River and Jimmy Durante Blvd.
NA = not available

Table 1.3 Flow Data for each monitored event.

Site/Event	Start Flow Date	Start Flow Time	End Flow Date	End Flow Time	Duration Flow (hours:minutes)	Total Flow (cubic feet)	Peak Flow (cfs)	Est. % Capture	Peak Capture	Detention Time (hours)
Event 1										
SR78/I15-IN	1/25/99	4:30	1/25/99	19:45	15:15:00	7157	0.47	100	Y	28.87
SR78/I15-EFF	1/25/99	6:08	1/26/99	9:22	27:14:00	8713	0.24	99	Y	
SR56/I5-IN	1/25/99	3:19	1/25/99	17:30	14:11:00	18910	2.07	100	Y	32.20
SR56/I5-EFF	1/25/99	4:30	1/26/99	11:31	31:01:00	14909	0.22	95	Y	
Event 2										
SR78/I15-IN	2/4/99	17:00	2/5/99	6:15	13:15:00	3390	0.51	84	Y	19.05
SR78/I15-EFF	2/4/99	15:07	2/5/99	12:03	20:56:00	5660	0.22	95	Y	
SR56/I5-IN	2/4/99	15:06	2/5/99	19:00	27:54:00	8443	2.83	100	Y	44.67
SR56/I5-EFF	2/4/99	16:00	2/6/99	11:46	43:46:00	13307	0.16	94	Y	
Event 3										
SR78/I15-IN	3/25/99	13:06	3/25/99	22:15	9:09:00	1552	0.21	100	Y	10.15
SR78/I15-EFF	3/25/99	14:31	3/25/99	23:15	8:44:00	3271	0.14	100	Y	
SR56/I5-IN	3/25/99	13:03	3/25/99	22:22	9:19:00	11880	1.1	98.5	Y	49.95
SR56/I5-EFF	3/25/99	13:48	3/27/99	15:00	49:12:00	12572	0.15	99.6	Y	
KEARNYMS-IN	3/25/99	13:09	3/25/99	19:30	6:21:00	6680[1]	0.74	100	Y	7.10
KEARNYMS-EFF	3/25/99	13:35	3/25/99	20:15	6:40:00	5593[1]	0.57	96	Y	
ESCONMS-IN	3/25/99	13:01	3/25/99	19:15	6:14:00	840	0.08	100	Y	5.98
ESCONMS-EFF	3/25/99	15:50	3/25/99	19:00	3:10:00	204	0.04	100	Y	
LACOSTAP&R-IN	3/25/99	13:00	3/26/99	1:00	12:00:00	1886	0.28	100	Y	23.75
LACOSTAP&R-EFF	3/25/99	14:54	3/26/99	12:45	21:51:00	1736[1]	0.04	100	Y	
SR78/I5P&R-IN	3/25/99	13:06	3/25/99	19:30	6:24:00	1830[1]	0.21	100	Y	19.35
SR78/I5P&R-EFF	3/25/99	13:46	3/26/99	8:27	18:41:00	2259[1]	0.06	100	Y	
Event 4										
SR78/I15-IN	4/7/99	3:59	4/7/99	10:45	6:46:00	4082	0.73	100	Y	24.02
SR78/I15-EFF	4/7/99	4:08	4/8/99	4:00	23:52:00	14894	0.34	100	Y	
SR56/I5-IN	4/7/99	9:00	4/7/99	15:30	6:30:00	NA	NA	10	N	15.25[2]
SR56/I5-EFF	4/7/99	9:15	4/8/99	0:15	15:00:00	3442	0.08	100	Y	
KEARNYMS-IN	4/6/99	17:45	4/7/99	15:21	21:36:00	1925	0.19	100	Y	21.77
KEARNYMS-EFF	4/6/99	18:20	4/7/99	15:31	21:11:00	1438	0.17	100	Y	
ESCONMS-IN	4/6/99	17:56	4/7/99	14:00	20:04:00	1659	0.35	100	Y	30.82
ESCONMS-EFF	4/7/99	4:06	4/8/99	0:45	20:39:00	1127	0.10	100	Y	
LACOSTAP&R-IN	4/6/99	19:00	4/7/99	10:00	15:00:00	424	0.20	100	Y	78.00
LACOSTAP&R-EFF	4/7/99	5:30	4/10/99	1:00	67:30:00	390	0.012	100	Y	
Event 5										
SR56/I5-IN	4/11/99	16:08	4/12/99	1:30	9:22:00	12378	3.08	93	Y	35.12
SR56/I5-EFF	4/11/99	18:22	4/13/99	3:15	32:53:00	9805	0.12	100	Y	
KEARNYMS-IN	4/11/99	16:42	4/12/99	13:38	20:56:00	7323	1.00	92	Y	21.20
KEARNYMS-EFF	4/11/99	17:08	4/12/99	13:54	20:46:00	7515	0.85	89	Y	
ESCONMS-IN	4/11/99	16:33	4/12/99	9:00	16:27:00	2309.00	0.24	87	Y	18.62
ESCONMS-EFF	4/11/99	22:18	4/12/99	11:10	12:52:00	1402	0.12	93	Y	
LACOSTAP&R-IN	4/11/99	16:06	4/12/99	10:45	18:39:00	2127	0.26	100	Y	40.18
LACOSTAP&R-EFF	4/11/99	16:48	4/13/99	8:17	39:29:00	4540	0.22	96	Y	
SR78/I5P&R-IN	4/11/99	15:55	4/12/99	3:00	11:05:00	1910	0.18	100	Y	21.95
SR78/I5P&R-EFF	4/11/99	17:48	4/12/99	13:52	20:04:00	1947	0.09	100	Y	

1 = Total flow estimate from secondary flow meter.
2 = Minor flow triggered SR-56/I5 EDB early on 4/6, most flow did not occur until a brief shower near 0800 on 4/7/99
NA = not available

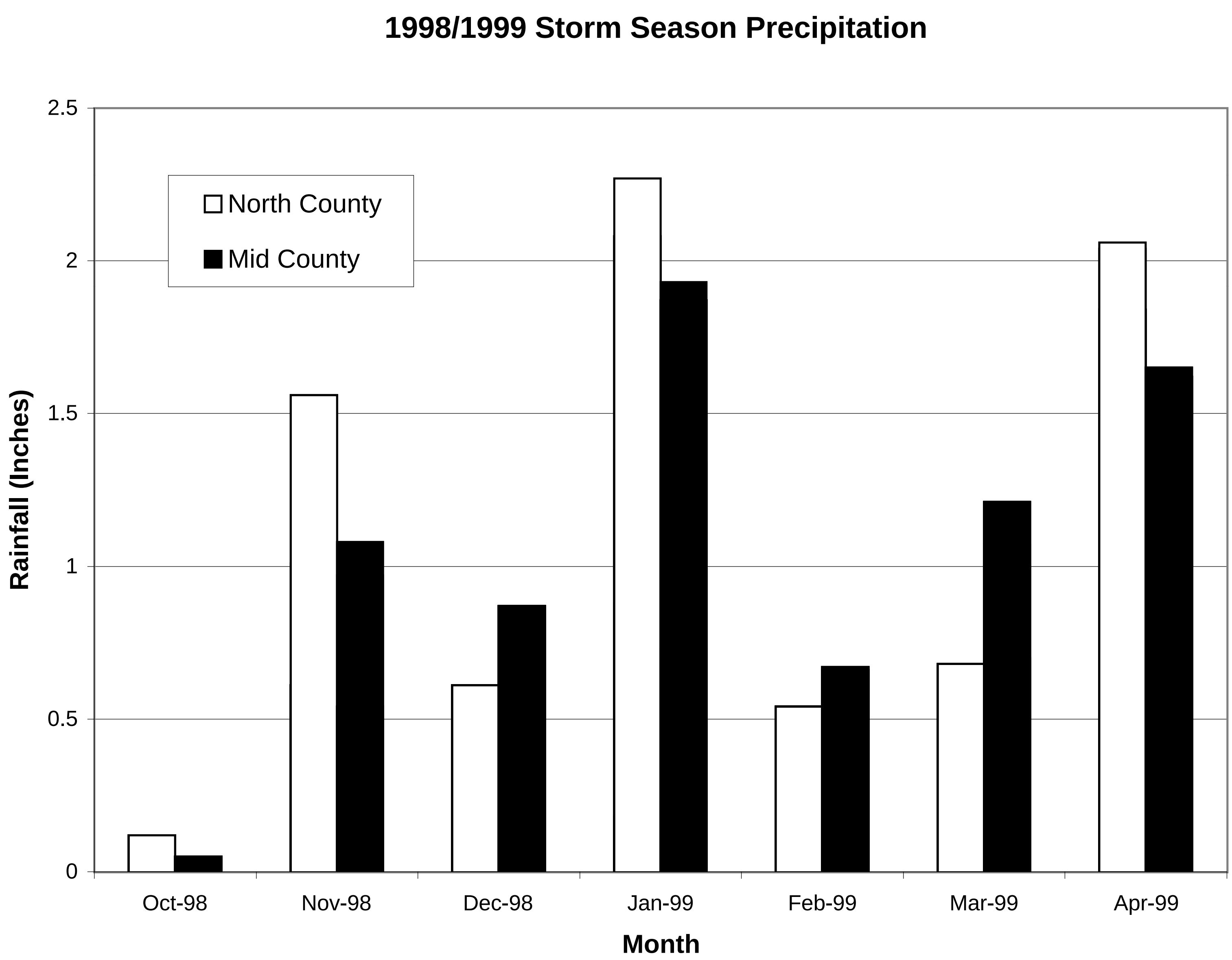


Figure 1.1 San Diego County monthly rainfall comparison.

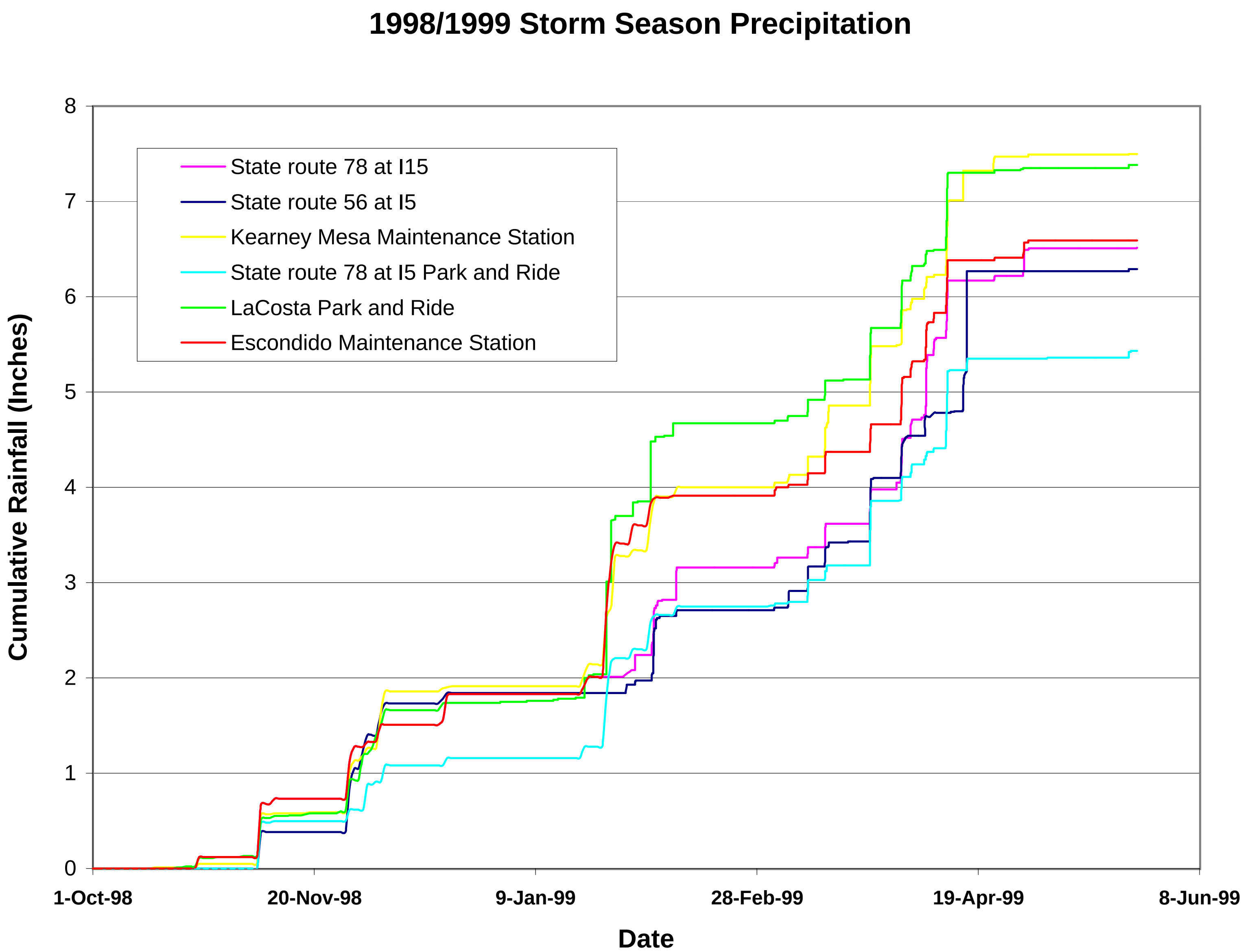


Figure 1.2 Cumulative seasonal rainfall for all monitored Caltrans BMP facilities.

the 25 January event. The least intense rain fell at the La Costa Avenue Park and Ride during Event 4. Here the maximum intensity was only 0.08 inches per hour.

1.1.3 Storm Water Runoff During Monitored Events

Monitoring was designed to isolate rainfall events and the runoff created by those events. Table 1.3 provides a summary of the runoff measured at each station in conjunction with each storm event. Figures 1.3 through 1.22 graphically summarize the influent and effluent flow during each monitored event at each BMP in response to rainfall. These figures also show how the aliquoting of each composite sample was conducted. Note that in several cases, equipment malfunctions, errors in sensor installations, and/or less than ideal flow conditions compromised the quality of the runoff data. However, in all but one case (Event 4 at the State Route 56 and I5 extended detention basin) the flow proportioning of each sample aliquot was more than adequate, even if not absolutely accurate. Problems encountered with the monitoring equipment will be discussed in more detail later.

In general, the drainage areas at each of the BMP sites are relatively small and impervious. This resulted in quick response times of inlet flow in relation to the advent of rain and fluctuations in rainfall intensity. As designed, the extended detention basin effluent discharges occurred at a steady regulated rate. In contrast, effluent flow from the Kearny Mesa media filter responded directly to rain fall intensity and inlet flow. Discharge flow from the sand filters responded directly to water levels within the pre-sedimentation chambers and indirectly to inflow intensity.

The extent at which discharge flow was regulated drove the total time runoff was retained in a facility. Detention times, calculated as the period between the start of inlet flow and the end of discharge flow, were highest for the La Costa Avenue sand filter (23.3 to 78 hours over 3 events) followed by the State Route 56 and I5 extended detention basin (15.25 to 44.7 hours over four events). Detention times calculated in this manner are somewhat misleading. Perhaps a better measure of how long a facility retains runoff may be by backing out the total time of inlet flow from the calculated detention time. Recalculating detention time in this manner shows that the La Costa Avenue sand filter held runoff for 11.3 to 63 hours after the cessation of inflow, and the State Route 56 and I5 detention basin held runoff for 8.7 to 40.7 after the cessation of inflow. The Kearny Mesa media filter only held runoff for 0.25 to 0.9 hours after the cessation of inflow.

The difference between the intensity of inlet and outlet flows is a further measure of the extent runoff is detained in a facility. Maximum outlet flows were as little as 3% of the maximum inlet flows at the State Route 56 and I5 extended detention basin. On the other end of the scale, maximum outlet flows from the Kearny Mesa media filter were only slightly less than the maximum inlet flows.

In many cases the total volume of runoff discharged from a BMP facility was only slightly different than the volume of runoff into the facility during any particular monitored event. Most of these differences can be attributed to the inability to accurately measure the very tail end of the discharge flow, infiltration, direct rainfall and runoff into the BMP, and water that is unable to flow out of presedimentation chambers and from amongst rocks. The short-term lockup of stage readings from the State Route 56 and I5 and State Route 78 and I15 discharge conveyances during Events 1 through 3 also led to slight inaccuracies in the total discharge volumes. In some cases, there were drastic differences between inlet and outlet flow volumes. It was determined by later investigations, using flow from tanked in water, that small abnormalities in some conveyances resulted in turbulent flow during low flow conditions. This was particularly true within the inlet and outlet conveyances at the State Route 78 and I15 extended detention basin. In order to improve the performance of area velocity meters during low flow conditions, new motherboards for the meters are being supplied by the meter manufacturer. Optimum repositioning of velocity sensors as a result of flow observations during calibrations is also underway.

The percent storm capture for most events at most sites was excellent (>90%). In one particular case (Event 4 at the State Route 56 and I5) the velocity sensor malfunctioned resulting in a storm capture (estimated from stage values) of around 10%. During the first event on 25 January sampling was called off early at the SR56 and I5 extended detention basin because of the start of another rain event.

Flow meter problems were encountered at some of the sites. There is, however, flow meter redundancy built into the systems where flumes are involved. Therefore, secondary flow data are available at many sites. For the purpose of summarizing these data, flow values from the secondary meters were used when problems were encountered with the primary flow meters.

The flow proportioning of sample aliquots was good in most cases. However, during Events 1 through 3 flow proportioning was driven by flow readings other than those presented in this report. At the State Route 78 and I15 extended detention basin during the first and second storm events, the flow metering equipment converted flume stage values less than 0.08 feet to zero flow. This was noticed immediately by storm control personnel and an offset was applied to the stage data to force the flow meter into sending positive flow values. Subsequently, the offset was removed from the stage values and the correct stage values were assigned flow values based on a table supplied by the flume manufacturer. After Event 2 the flume was replaced with an area velocity meter. During the third event at the inlet and outlets to the Kearny Mesa Maintenance Station and State Route 78 and I5 Park and Ride media filters and at the outlet to the La Costa Avenue sand filter flume stage values locked for short periods of time causing inadequacies in the flume flow data and sample proportioning. Except at the State Route 78 and I5 Park and Ride, the effect on flow proportioning appears to be minimal. It was determined later that the flow values from the secondary flow meter at each location were more accurate

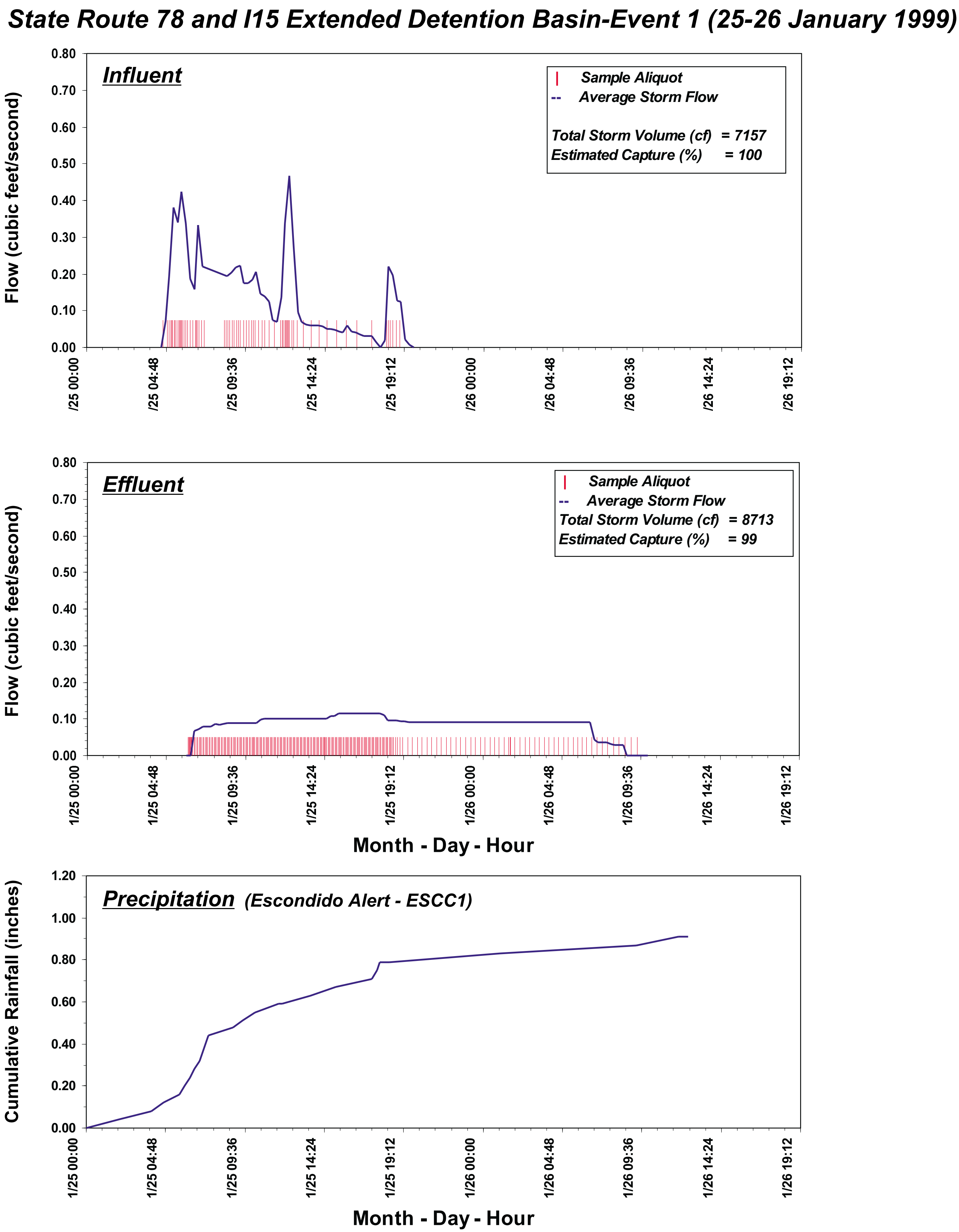


Figure 1.3. Average Flow and Cumulative Rainfall at State Route 78 and I15 for Event 1 (25-26 January 1999).

State Route 56 and I5 Extended Detention Basin-Event 1 (25-26 January 1999)

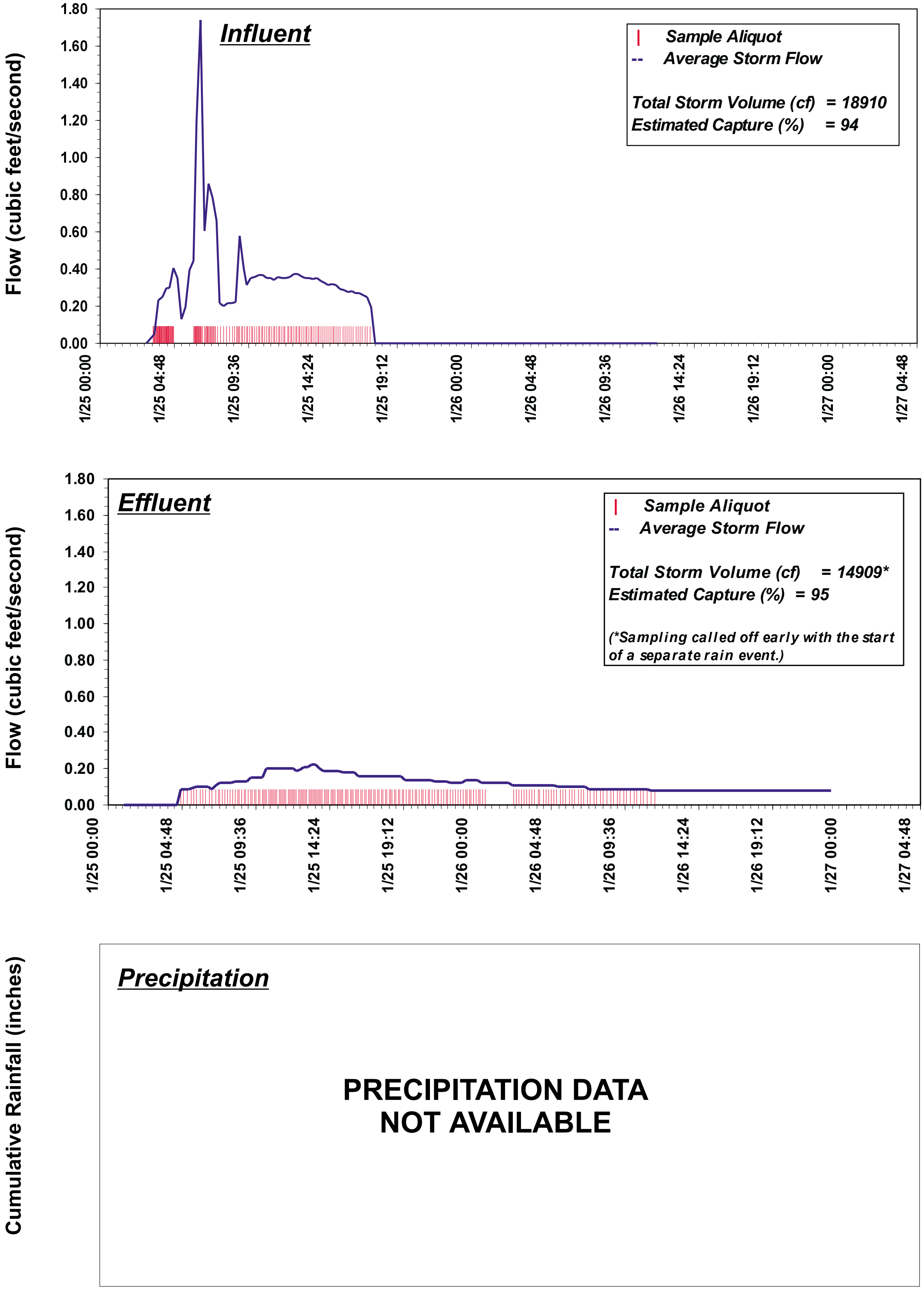


Figure 1.4. Average Flow and Cumulative Rainfall at State Route 56 and I5 for Event 1 (25-26 January 1999).

State Route 78 and I15 Extended Detention Basin-Event 2 (4-5 February 1999)

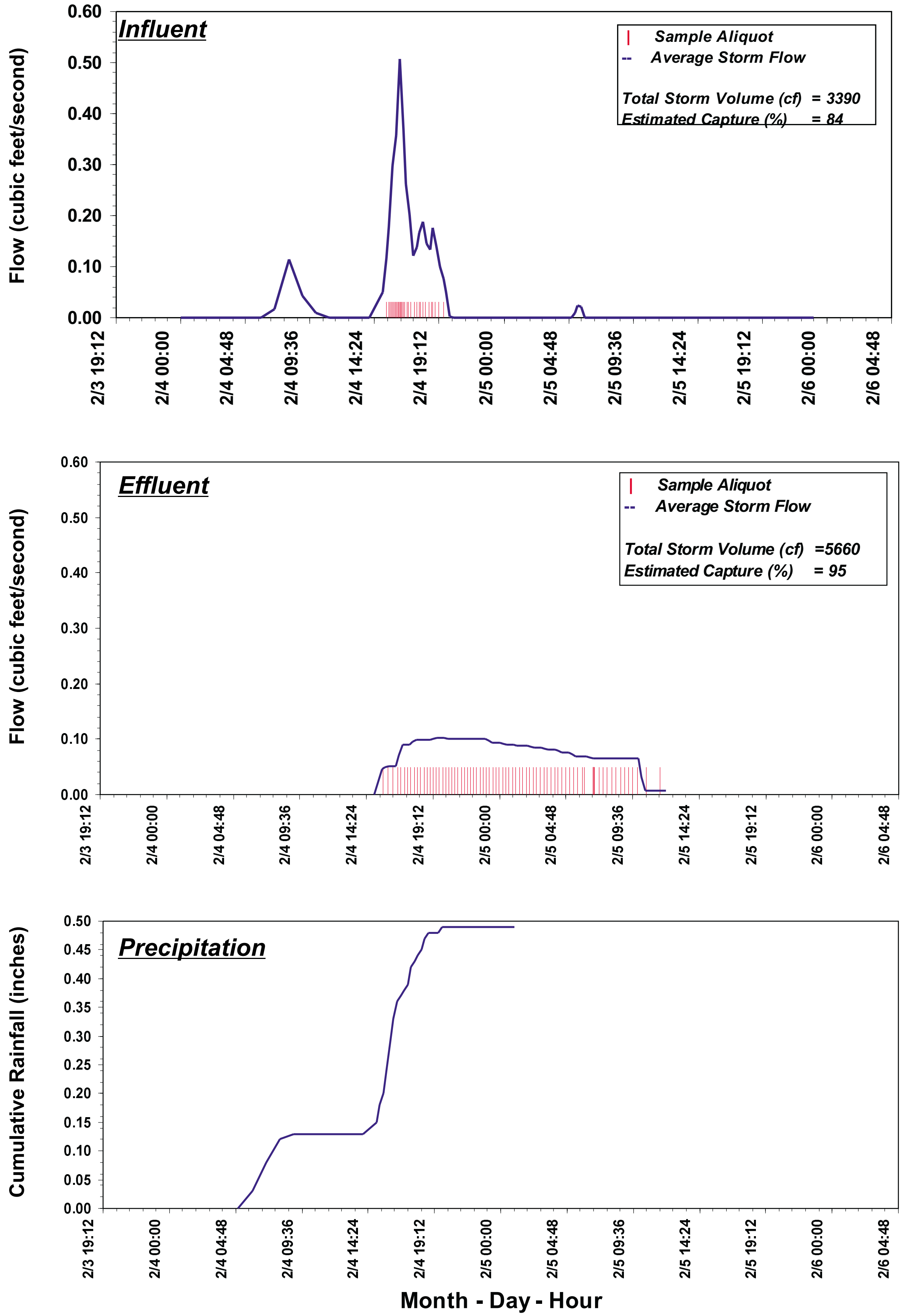


Figure 1.5. Average Flow and Cumulative Rainfall at State Route 78 and I15 for Event 2 (4-5 February 1999).

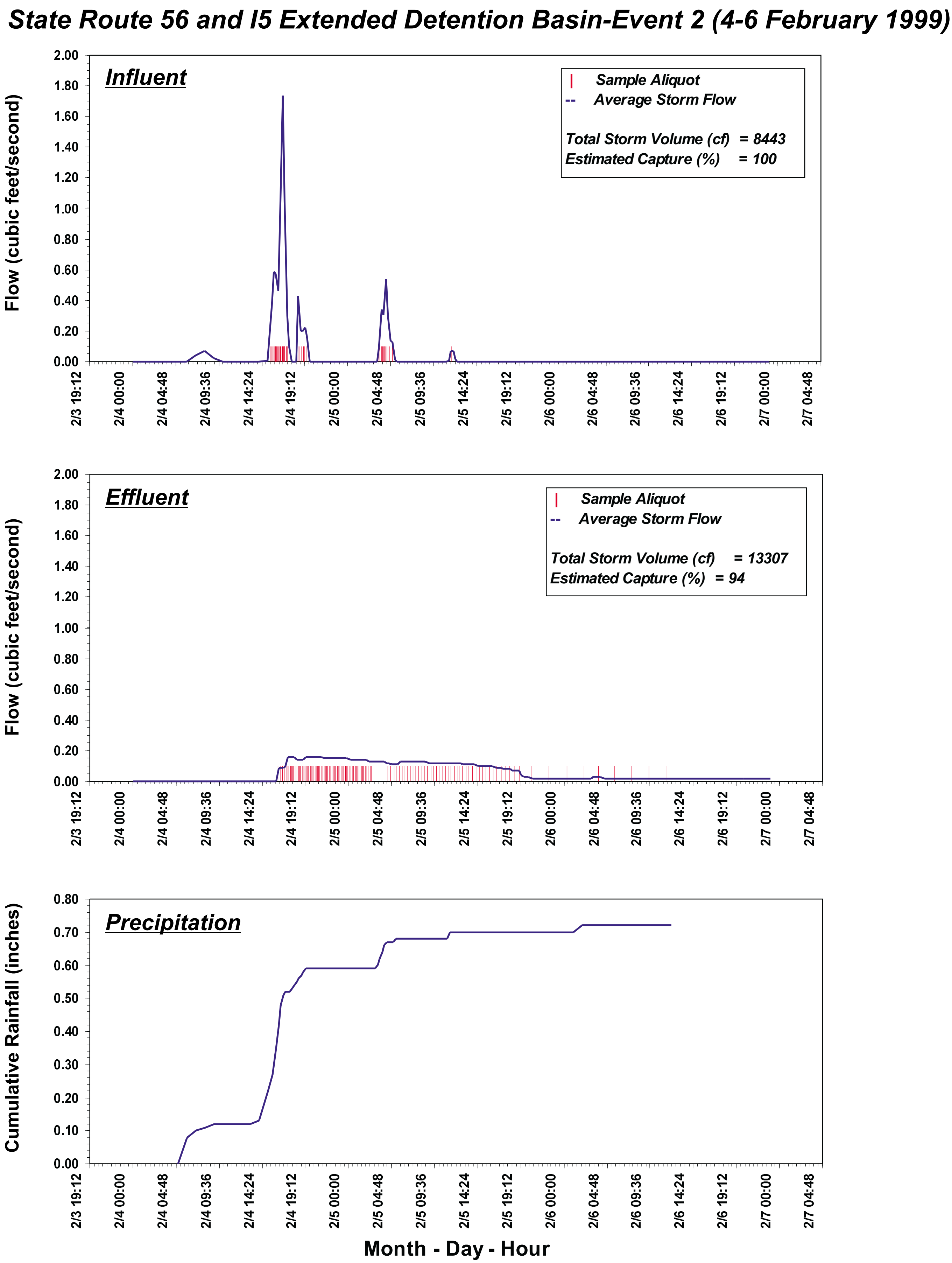


Figure 1.6. Average Flow and Cumulative Rainfall at State Route 56 and I5 for Event 2 (4-6 February 1999).

State Route 78 and I15 Extended Detention Basin-Event 3 (25 March 1999)

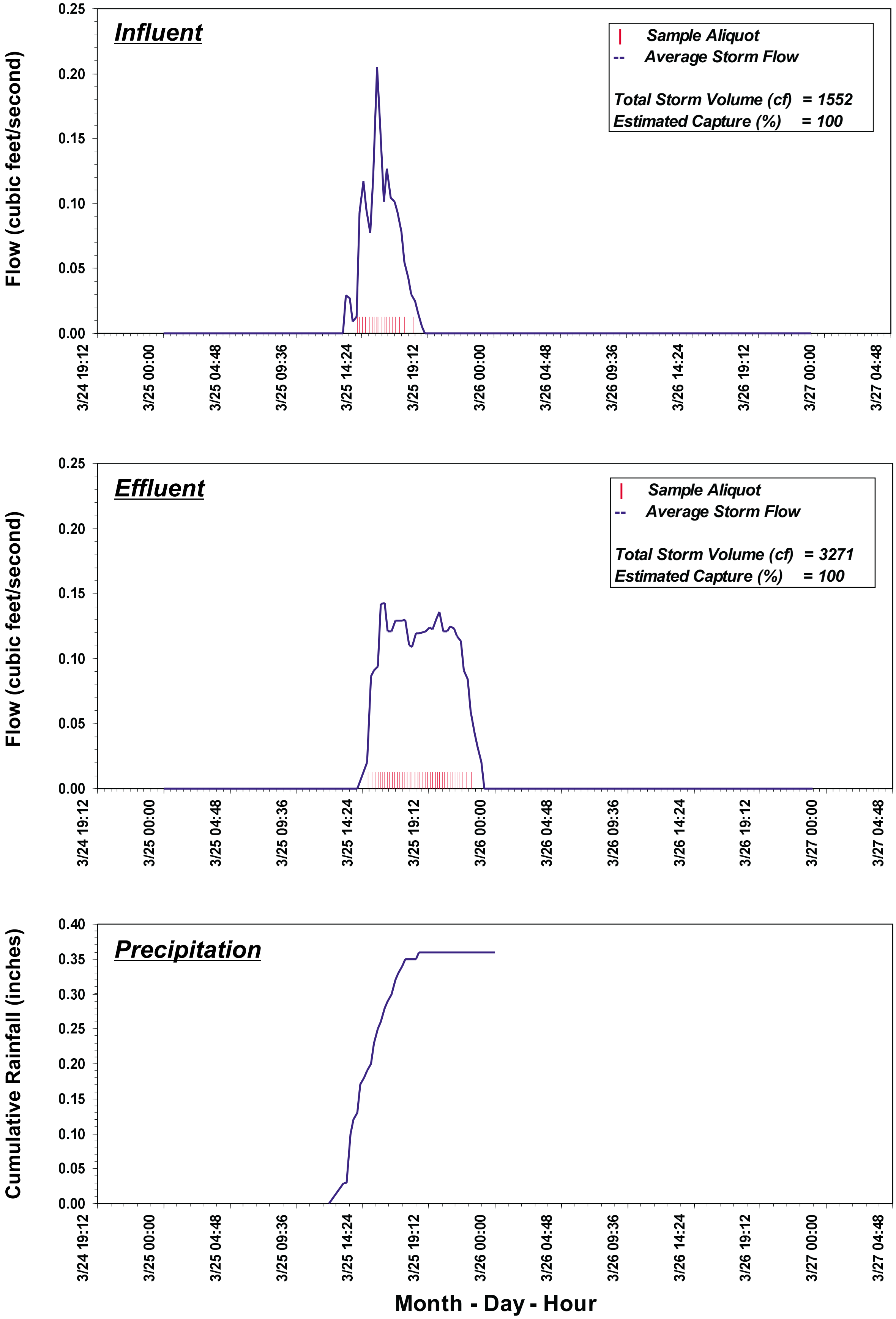


Figure 1.7. Average Flow and Cumulative Rainfall at State Route 78 and I15 for Event 3 (25 March 1999).

State Route 56 and I5 Extended Detention Basin-Event 3 (25-27 March 1999)

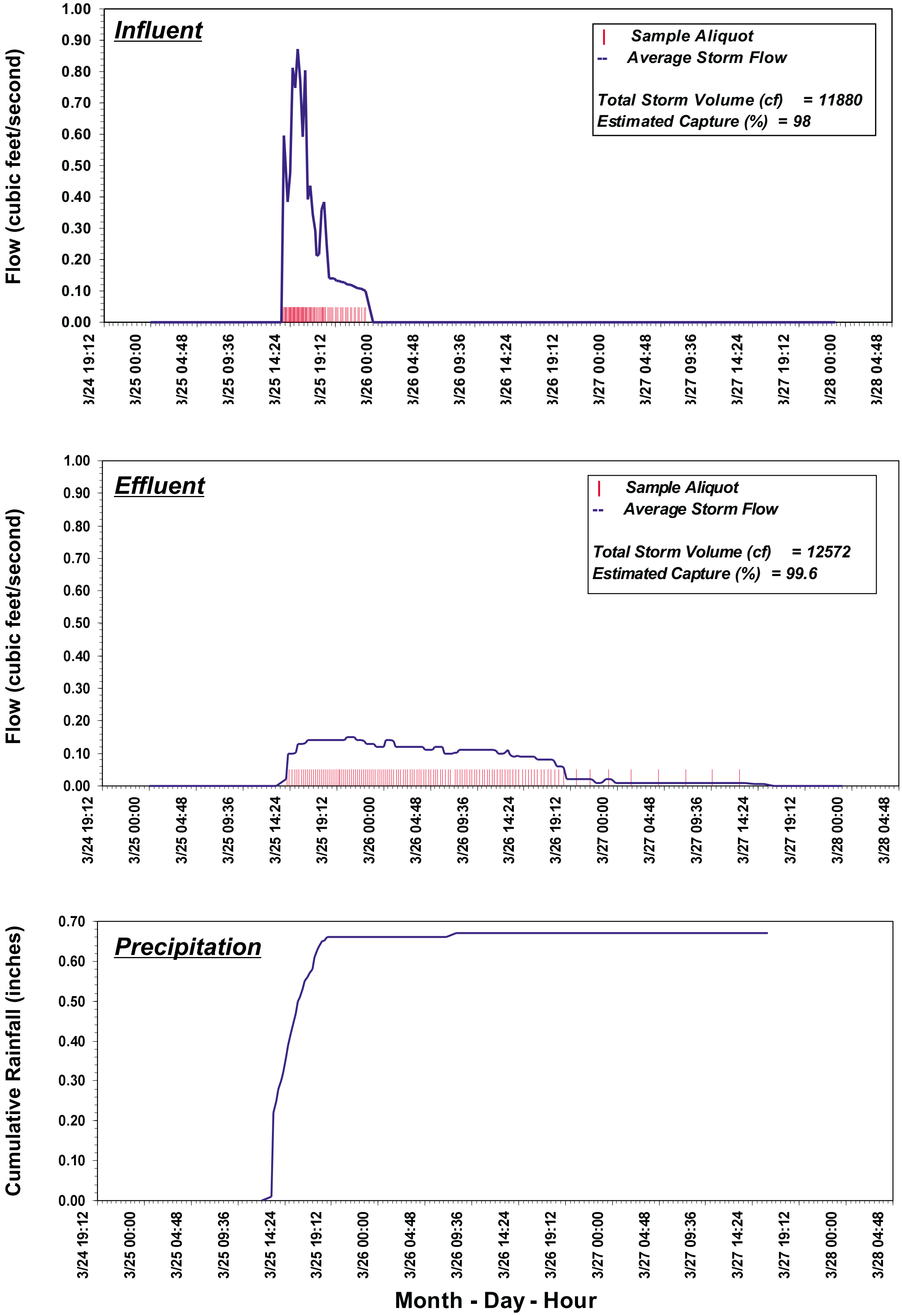


Figure 1.8. Average Flow and Cumulative Rainfall at State Route 56 and I5 for Event 3 (25-27 March 1999).

Kearny Mesa Media Filter-Event 3 (25 March 1999)

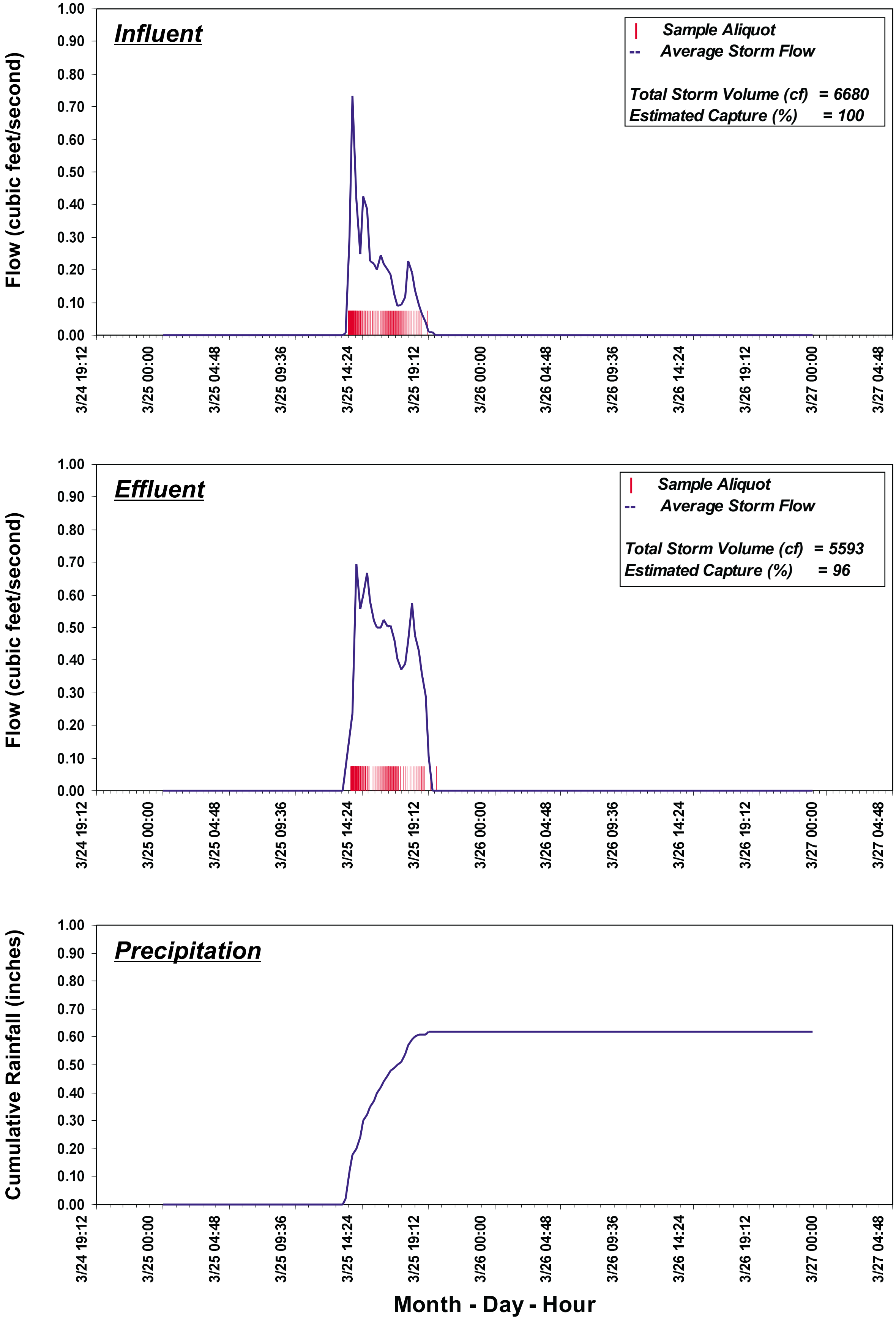


Figure 1.9. Average Flow and Cumulative Rainfall at Kearny Mesa for Event 3 (25 March 1999).

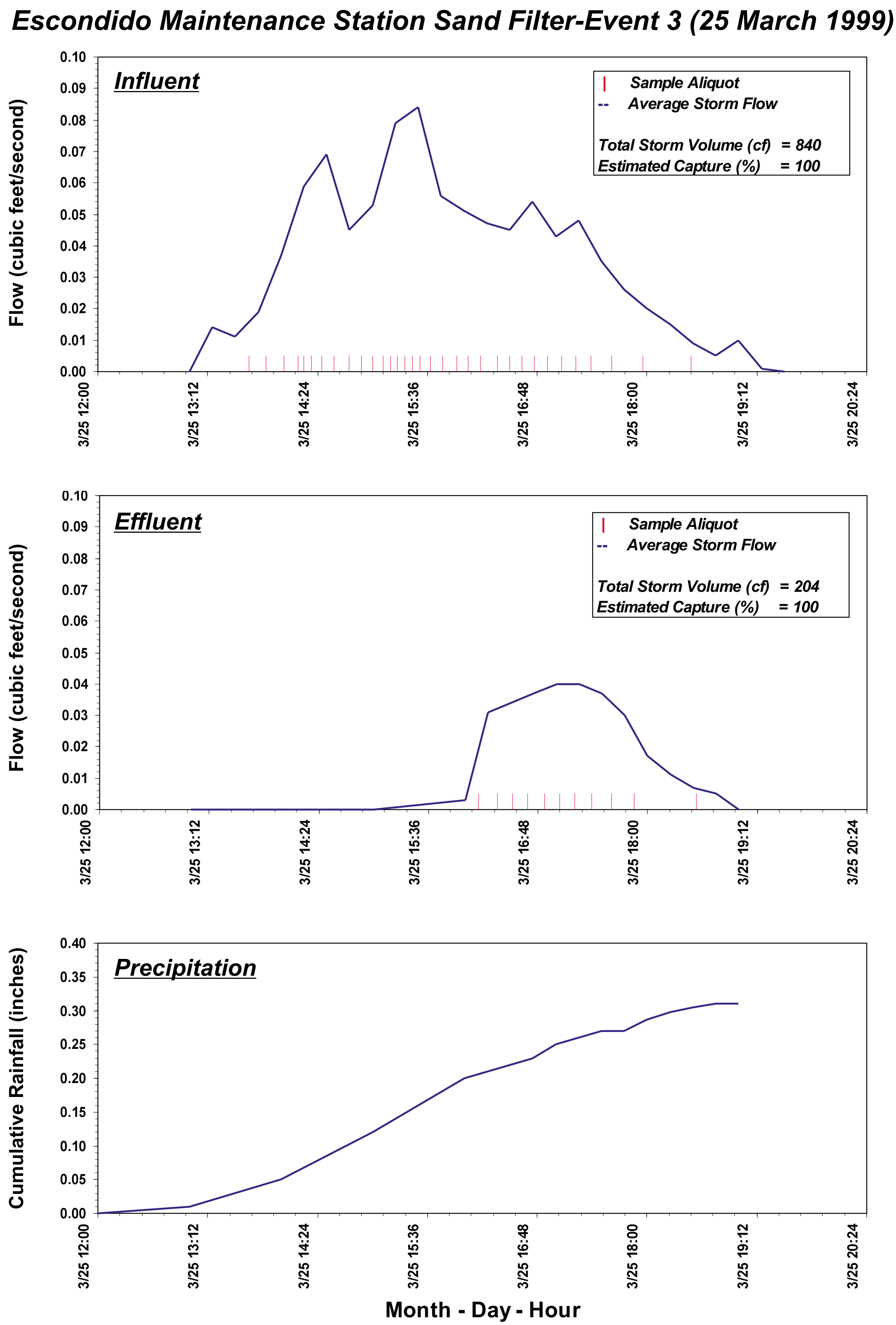


Figure 1.10. Average Flow and Cumulative Rainfall at Escondido Maintenance Station for Event 3 (25 March 1999).

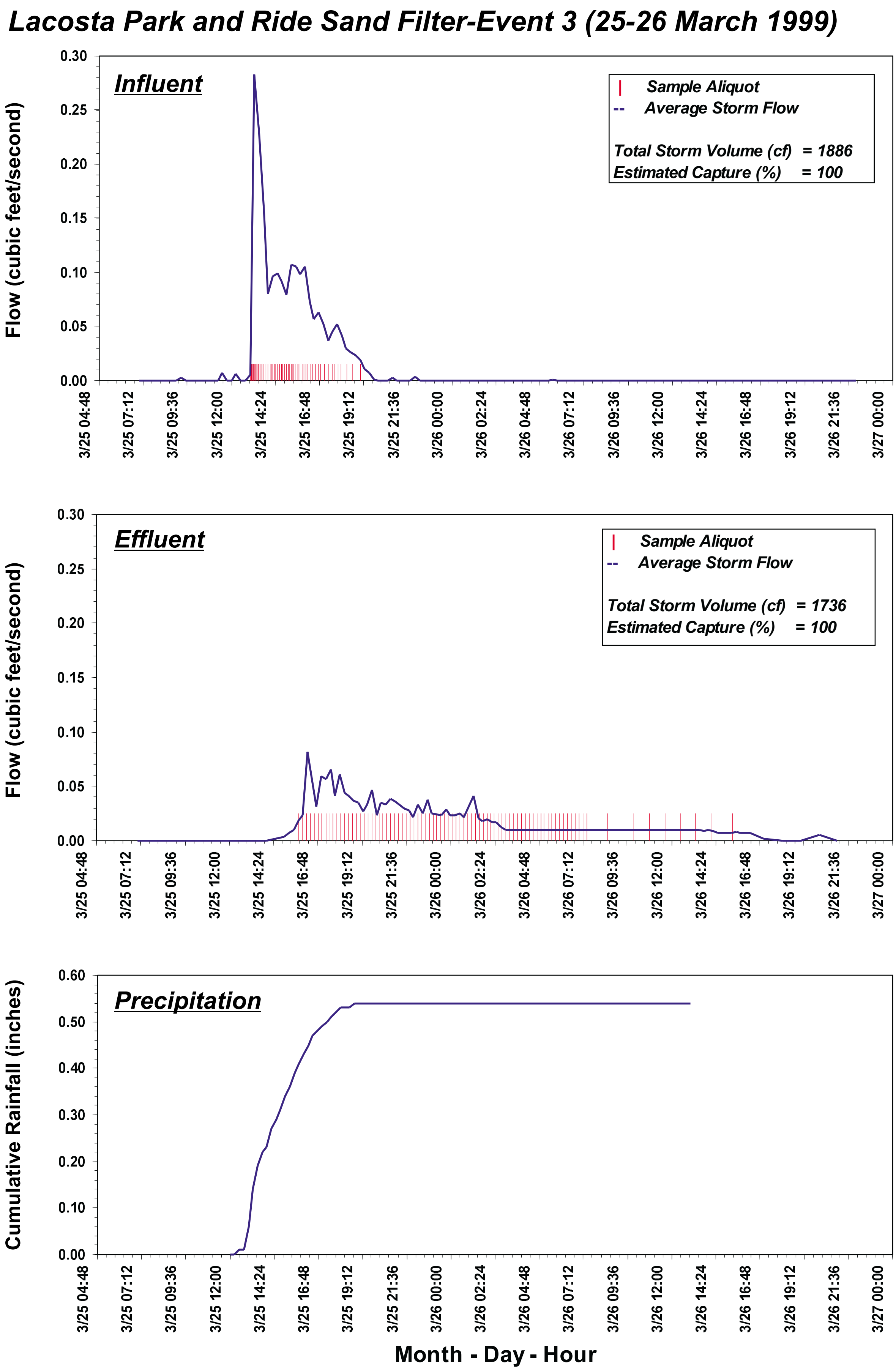


Figure 1.11. Average Flow and Cumulative Rainfall at Lacosta Park and Ride for Event 3 (25-26 March 1999).

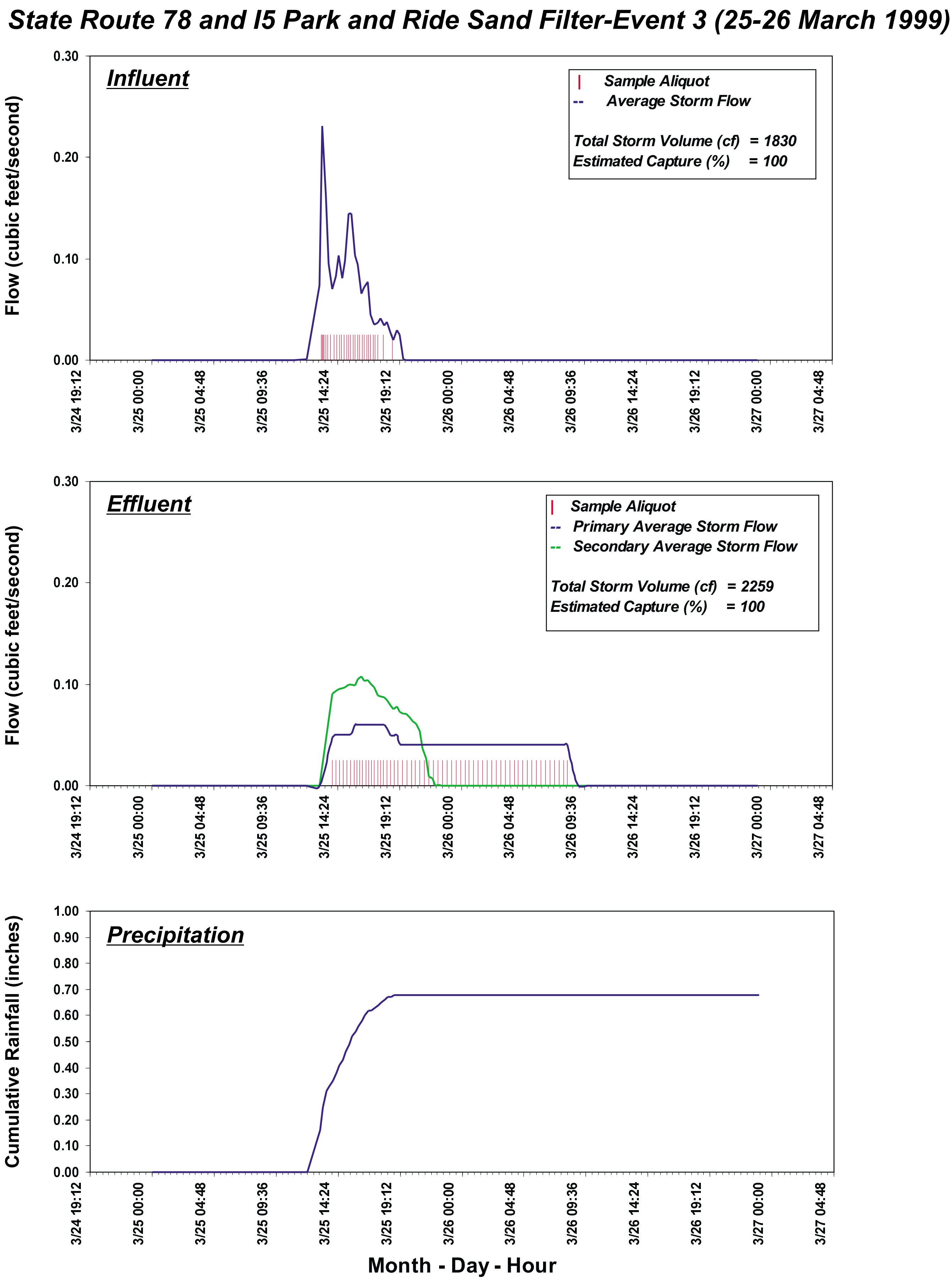


Figure 1.12. Average Flow and Cumulative Rainfall at State Route 78 and I5 Park and Ride for Event 3 (25-26 March 1999).

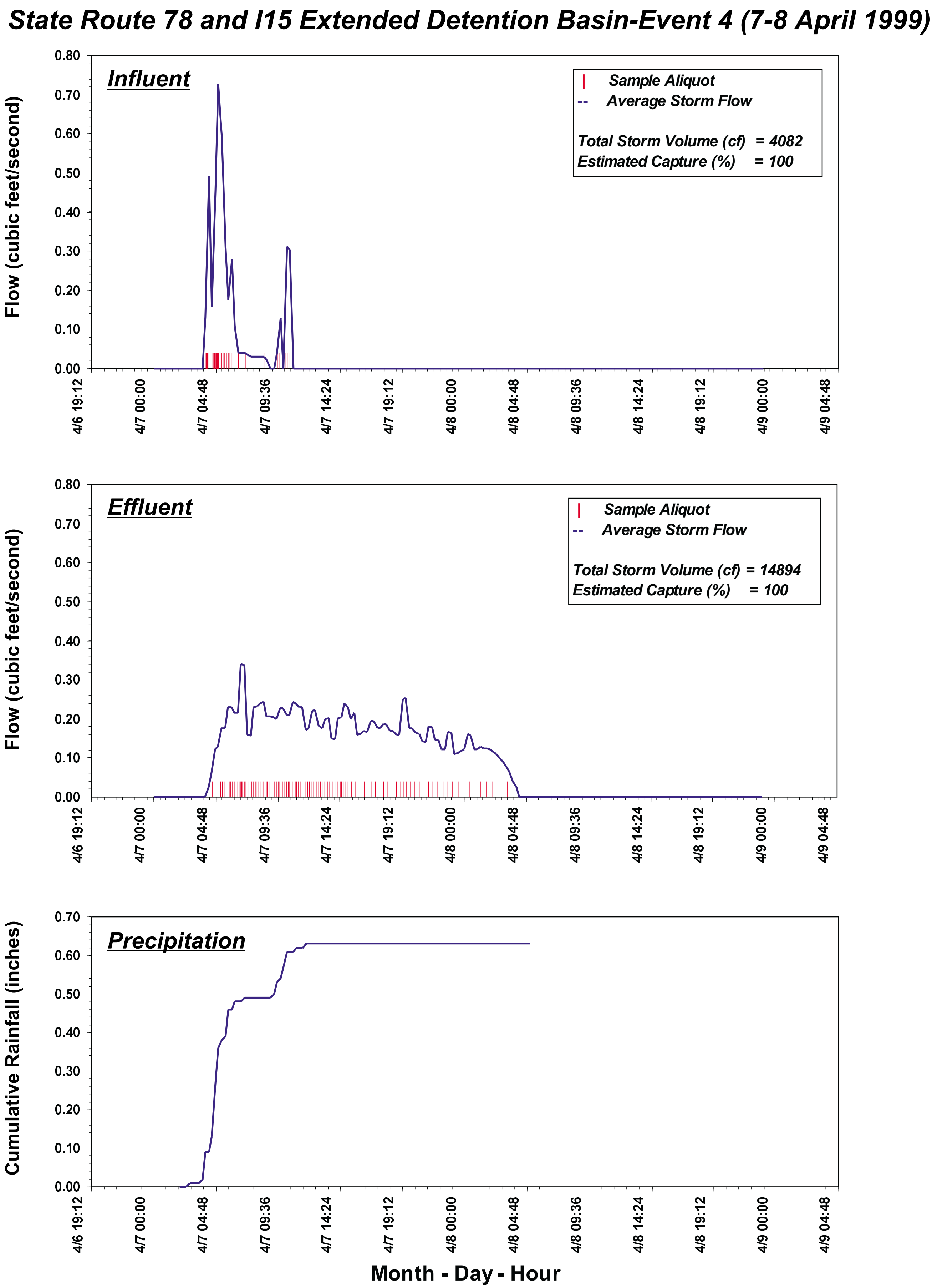


Figure 1.13. Average Flow and Cumulative Rainfall at State Route 78 and I15 for Event 4 (7-8 April 1999).

State Route 56 and I5 Extended Detention Basin-Event 4 (6-8 April 1999)

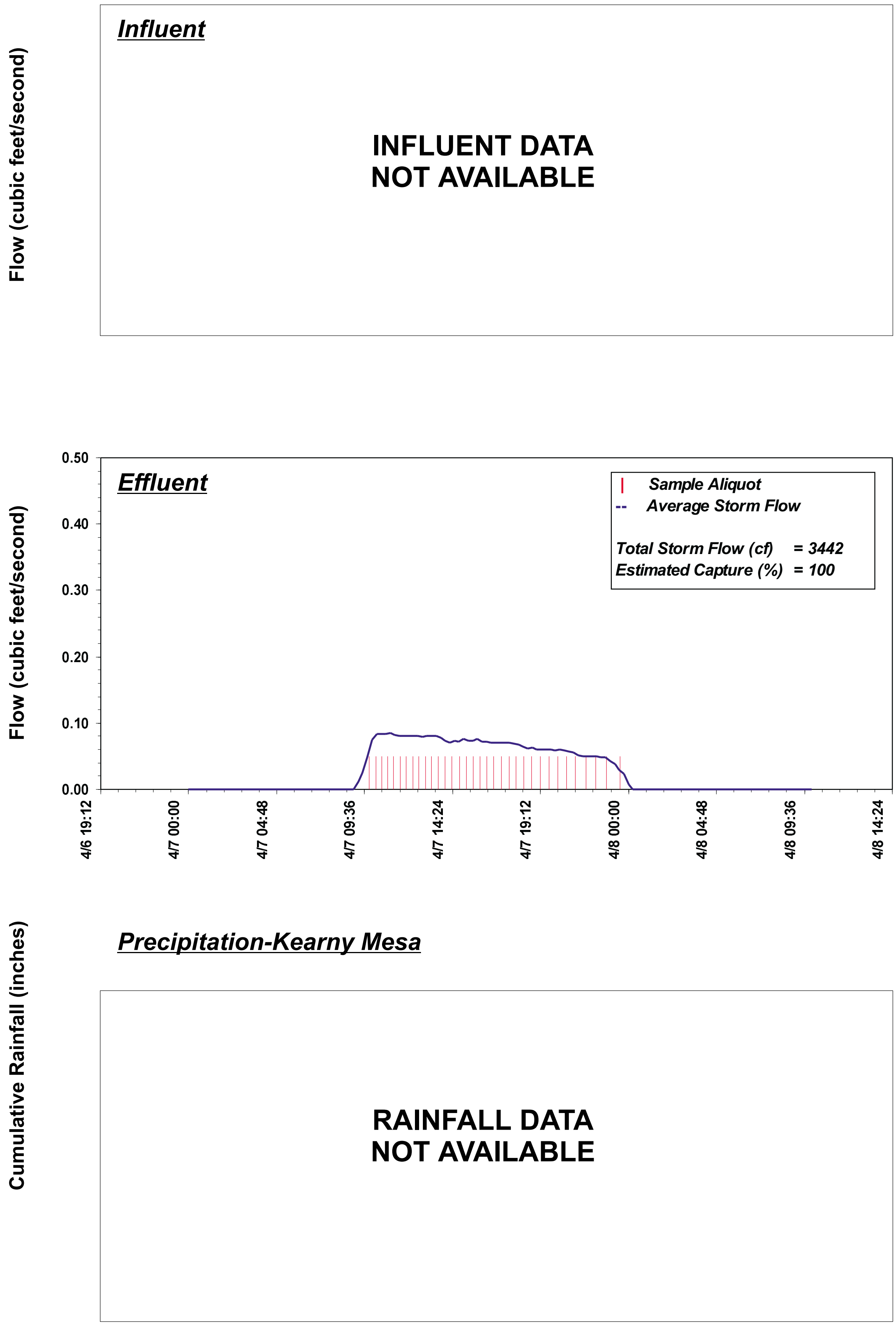


Figure 1.14. Average Flow and Cumulative Rainfall at State Route 56 and I5 for Event 4 (6-8 April 1999).

Kearny Mesa Media Filter-Event 4 (6-7 April 1999)

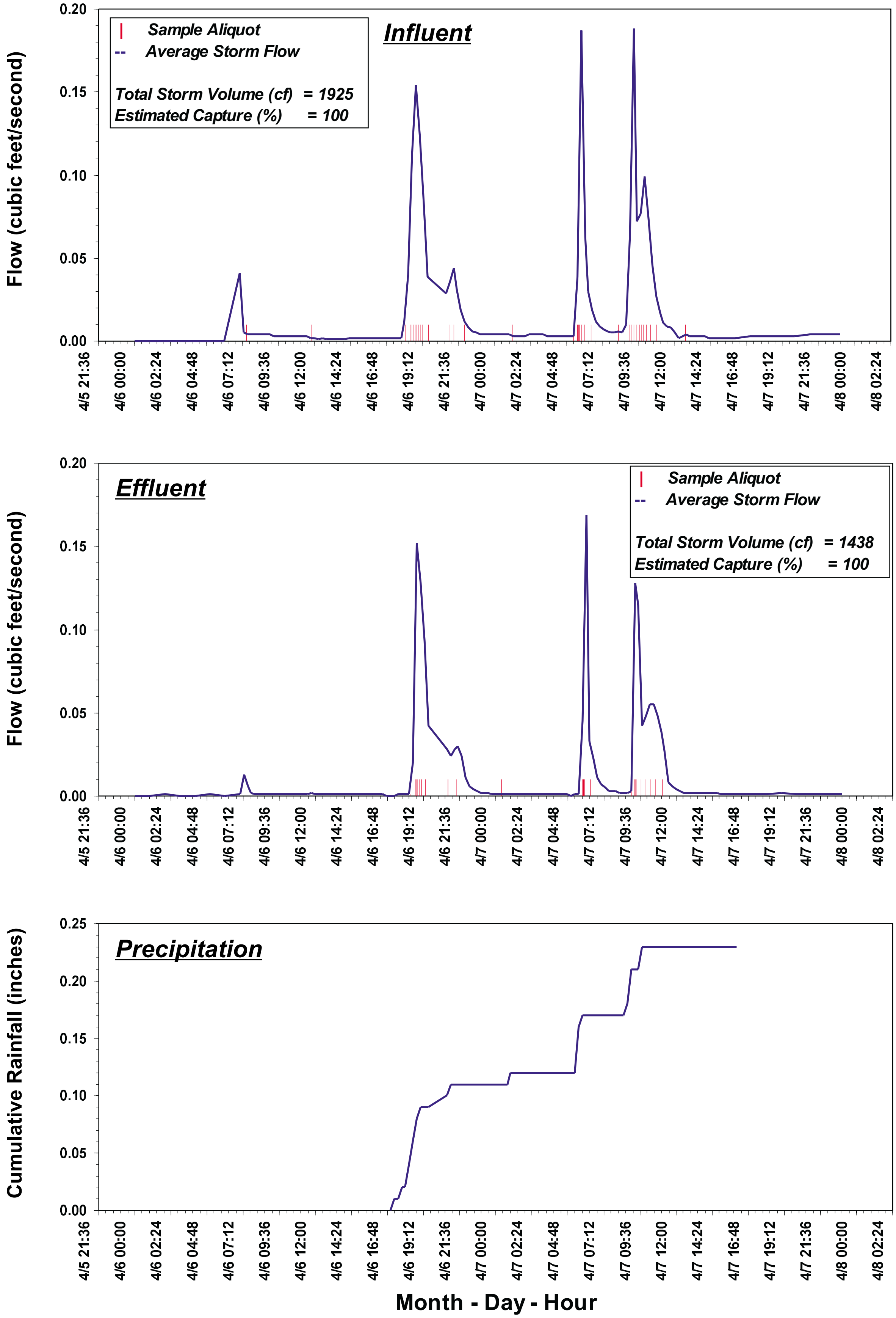


Figure 1.15. Average Flow and Cumulative Rainfall at Kearny Mesa for Event 4 (6-7 April 1999).

Escondido Maintenance Station Sand Filter-Event 4 (6-8 April 1999)

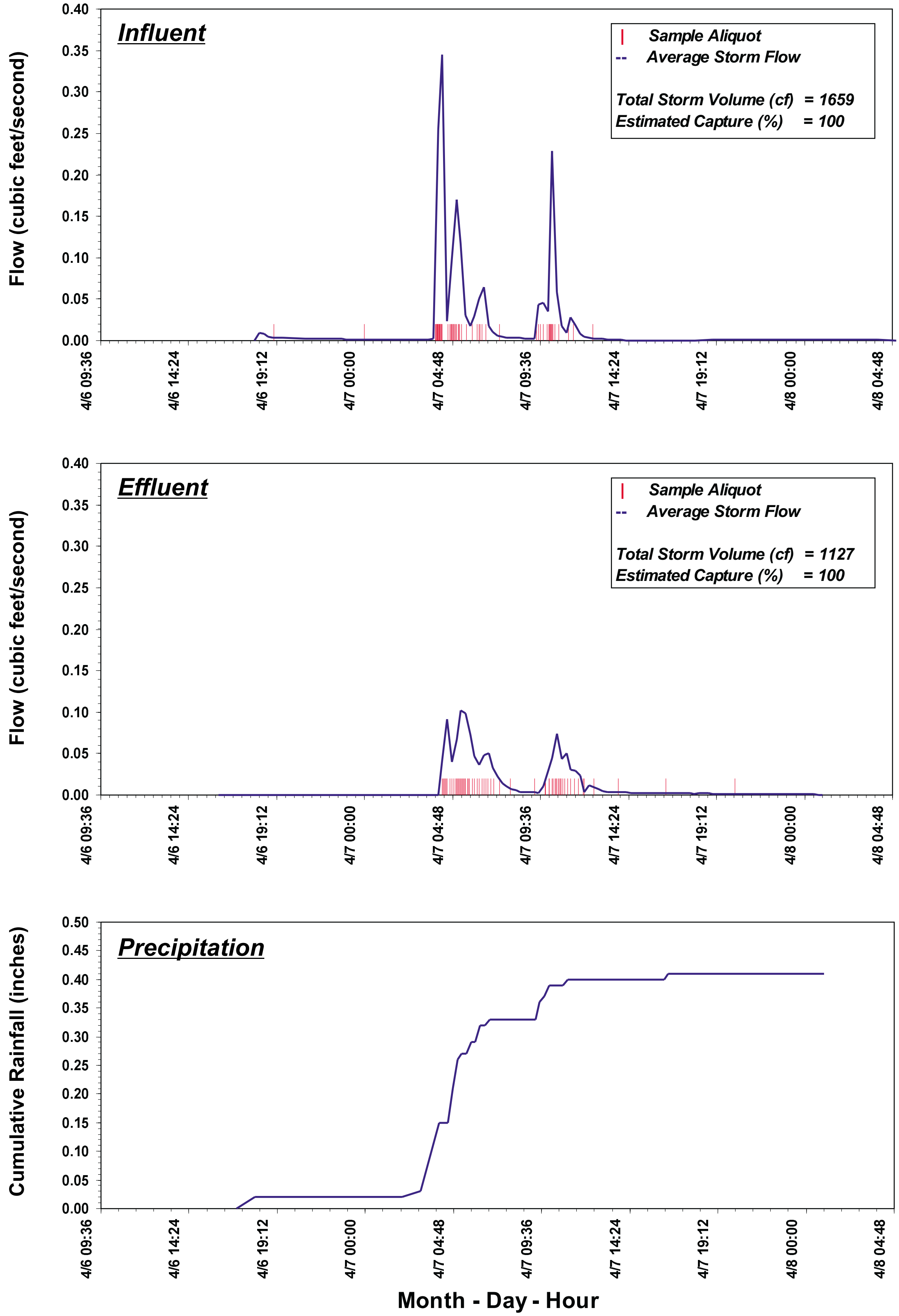


Figure 1.16. Average Flow and Cumulative Rainfall at Escondido Maintenance Station for Event 4 (6-8 April 1999).

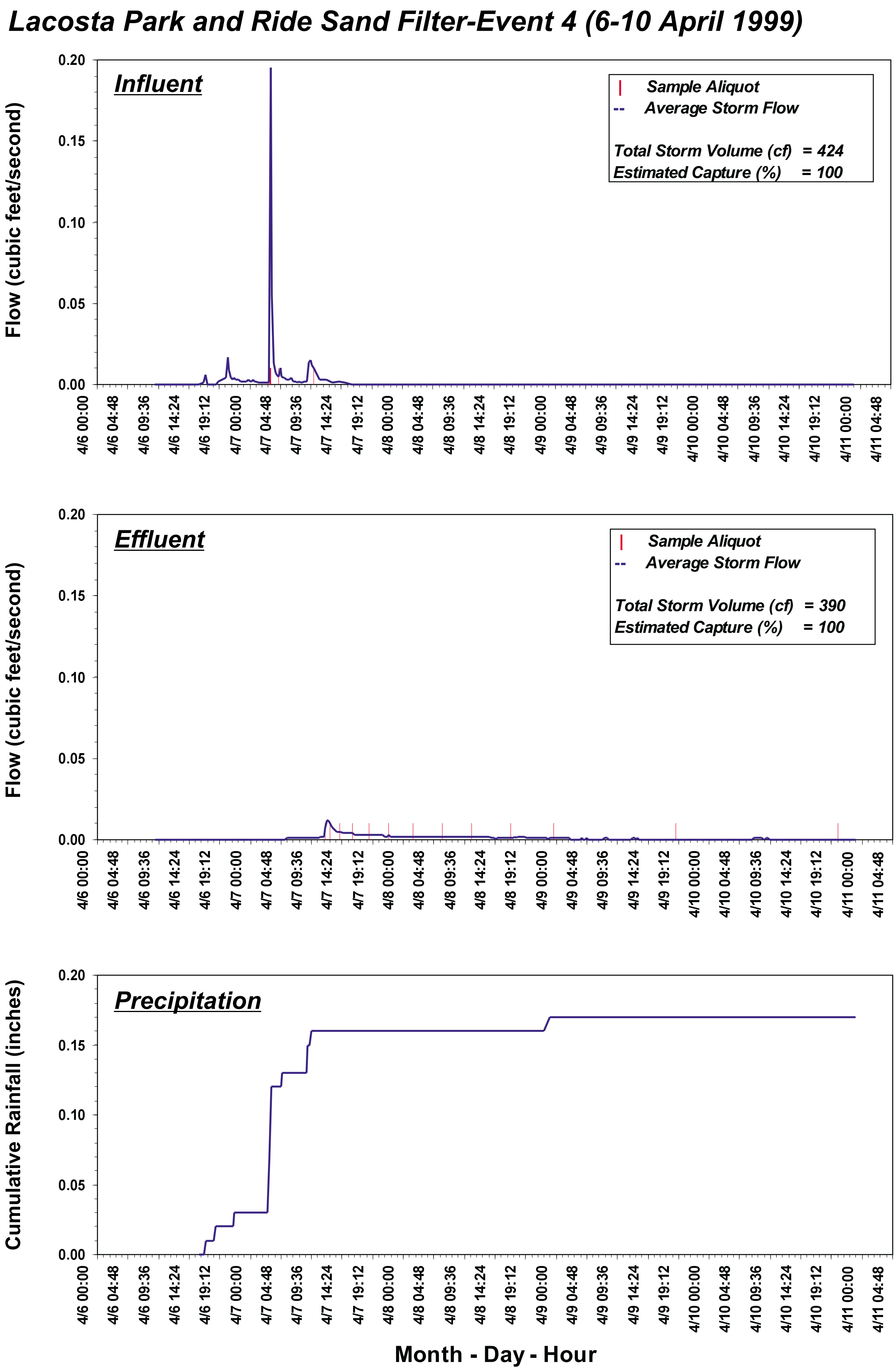


Figure 1.17. Average Flow and Cumulative Rainfall at Lacosta Park and Ride for Event 4 (6-10 April 1999).

State Route 56 and I5 Extended Detention Basin-Event 5 (11-13 April 1999)

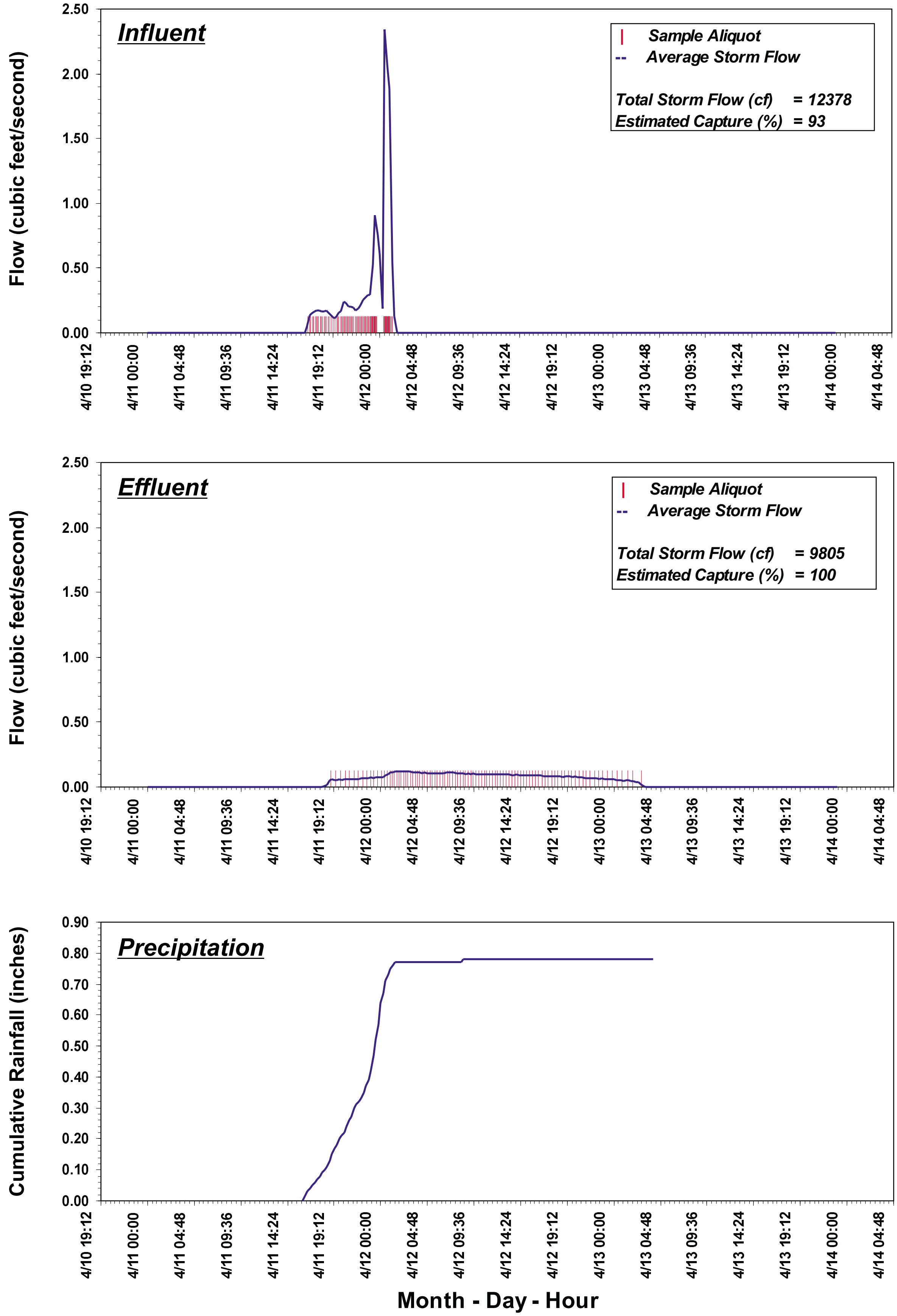


Figure 1.18. Average Flow and Cumulative Rainfall at State Route 56 and I5 for Event 5 (11-13 April 1999).

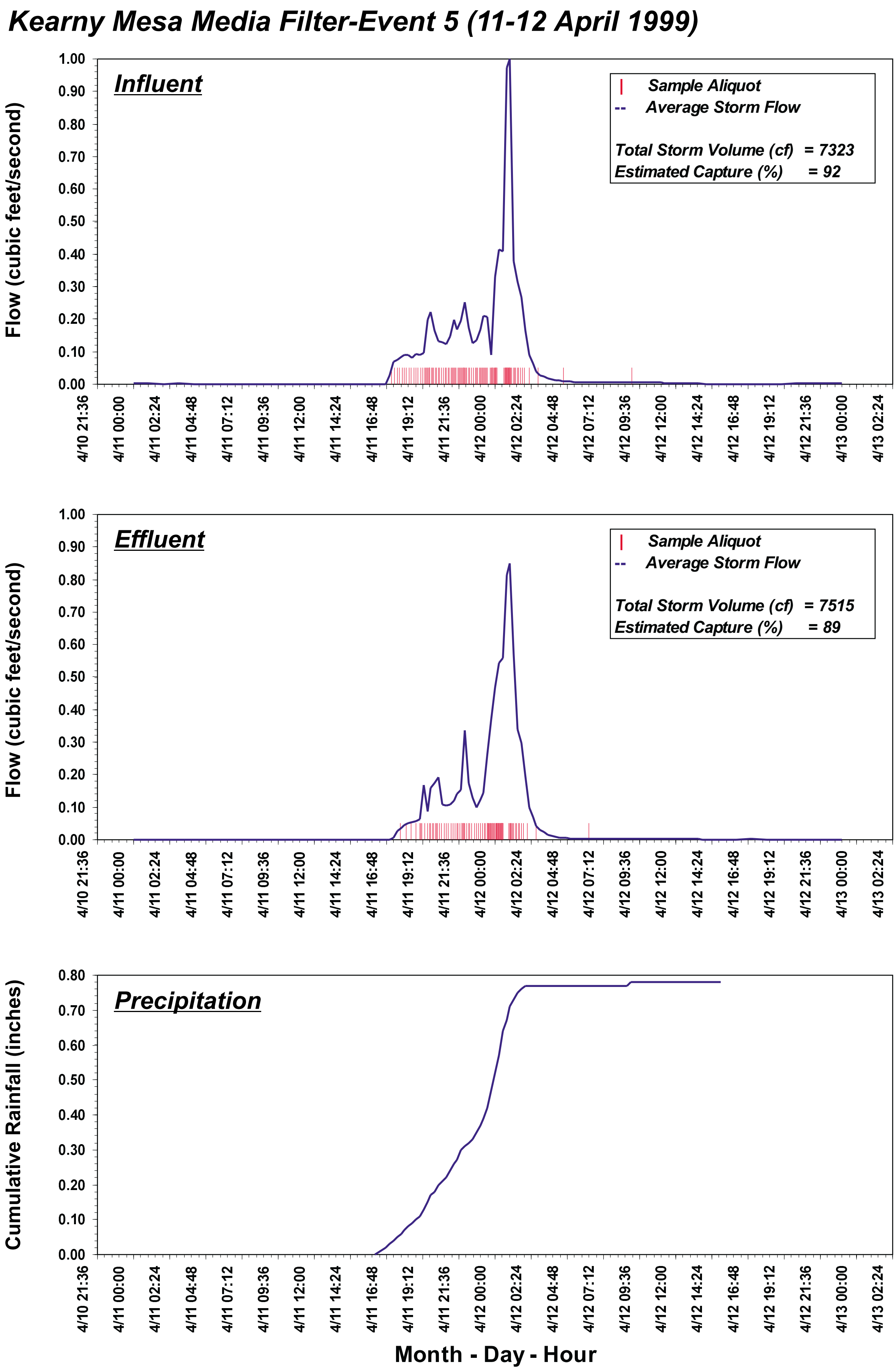


Figure 1.19. Average Flow and Cumulative Rainfall at Kearny Mesa for Event 5 (11-12 April 1999).

Escondido Maintenance Station Sand Filter-Event 5 (11-12 April 1999)

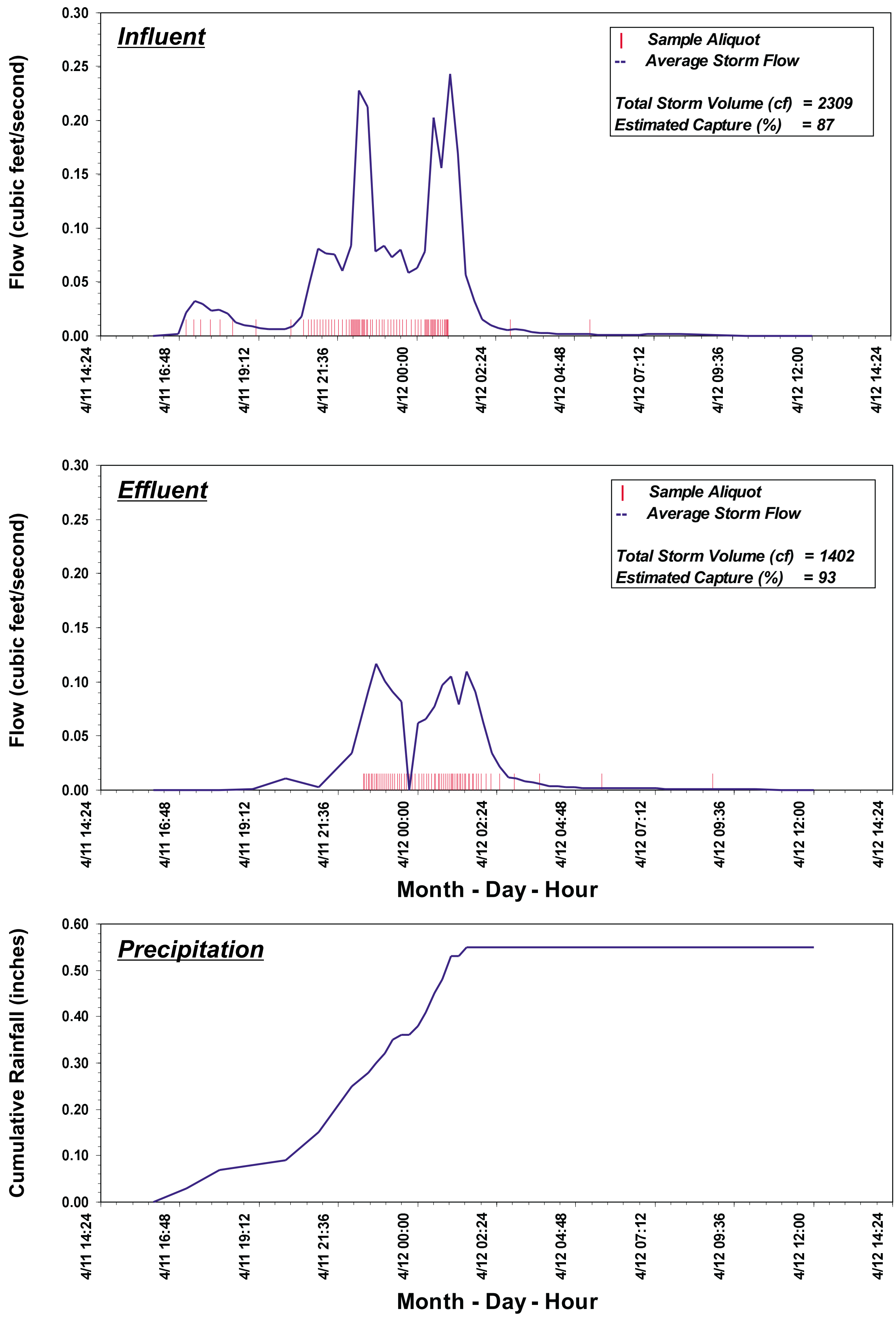


Figure 1.20. Average Flow and Cumulative Rainfall at Escondido Maintenance Station for Event 5 (11-12 April 1999).

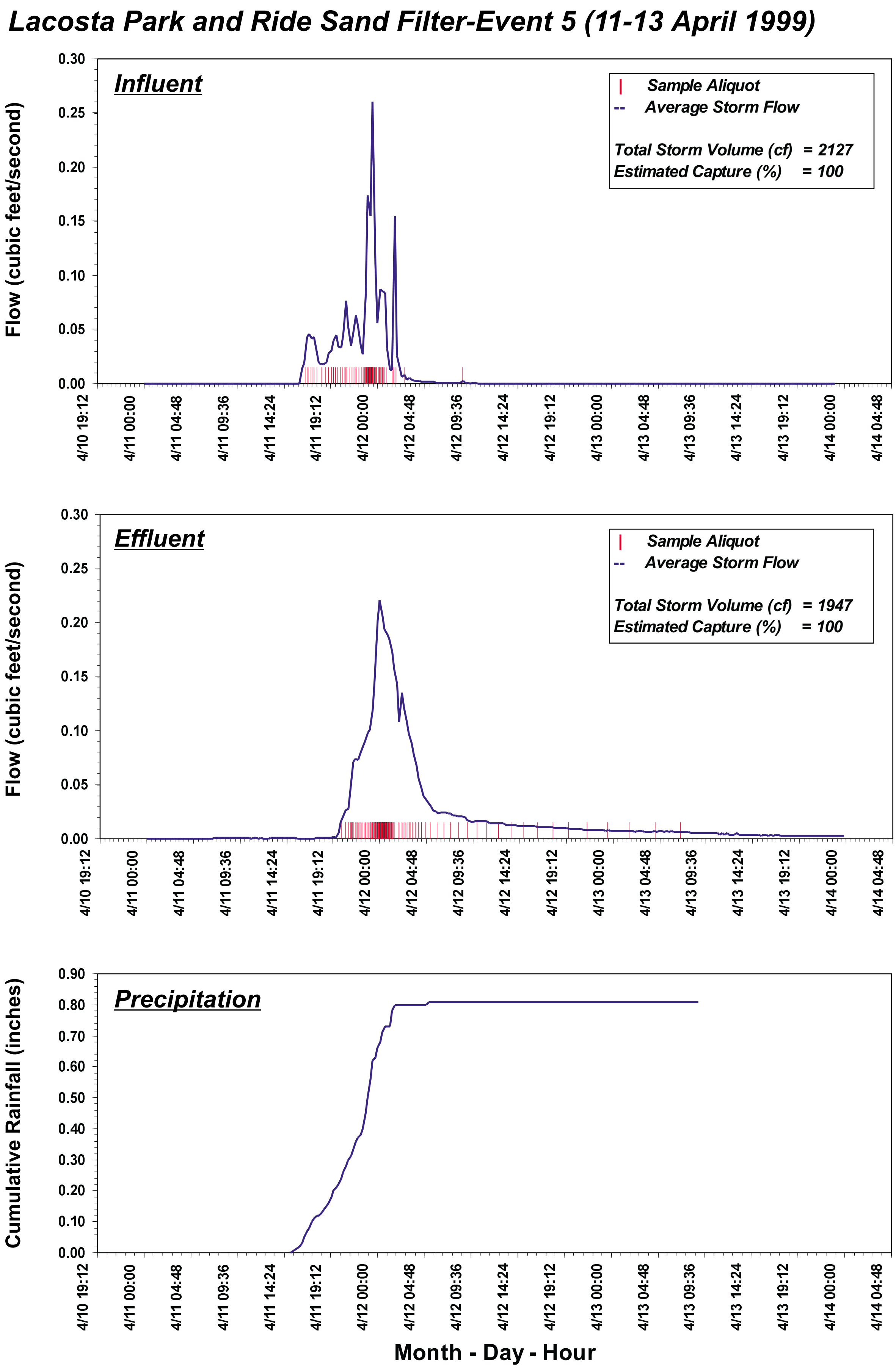


Figure 1.21. Average Flow and Cumulative Rainfall at Lacosta Park and Ride for Event 5 (11-13 April 1999).

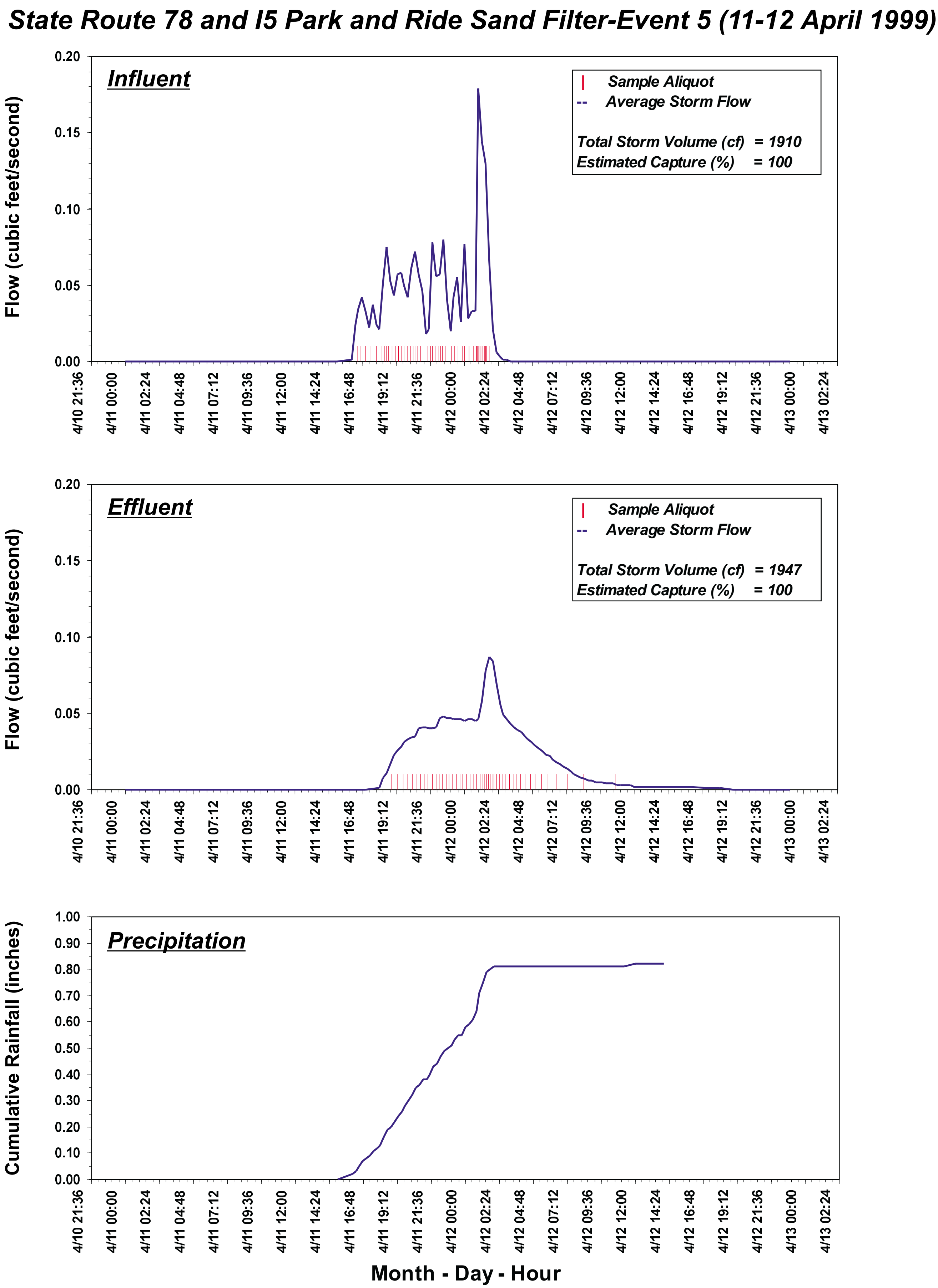


Figure 1.22. Average Flow and Cumulative Rainfall at State Route 78 and I5 Park and Ride for Event 5 (11-12 April 1999).

and reliable than the primary flow data which drove the flow proportioning. The secondary flow data is presented in this report. Data from both flow meters are presented in Figure 1.12 for the State Route 78 and I5 Park and Ride effluent to illustrate the magnitude of the flow proportioning problem that occurred at that site. The problem of locking stage values was corrected after the third event at all sites and was not observed anywhere during subsequent storm events.

1.2 Water Quality Results

The following sections provide an assessment of the overall quality of the data set, a summary of water quality data for each event, and a preliminary examination of performance of the BMPs.

1.2.1 Assessment of Quality Assurance/Quality Control Results

Overall, data quality was found to meet the program objectives. Very little evidence of contamination was detected in numerous blanking tests conducted to assess potential sources of contaminants in field sampling equipment, subsampling equipment, sample containers and testing procedures. With the exception of bacteria, all analyses were conducted within the required holding times. Although bacteria could not be analyzed within the preferred holding time of 6 hours, all analyses were conducted within 24 hours of sample collection.

Analysis of trace metals and nutrients generally met accuracy objectives for matrix spikes, matrix spike duplicates, laboratory control standards (LCS), and standard reference materials.

Precision as measured by the relative percent difference for matrix spike/spike duplicate and laboratory duplicates were all within project QA objectives. Field duplicate variability, however, was occasionally high. The following sections provide detailed results of the QA/QC assessment.

1.2.1.1 Blanks

Field and laboratory blanks were run in association with all phases of sample collection and analysis to document potential sources of contamination. These included intake tubing used to collect samples in the field, tubing or hose used to subsample from the 20-L borosilicate composite bottles, sample containers used to submit water to the laboratories, and analytical method blanks.

Seven subsampling hose assemblies were blanked (Table 1.4). These included approximately six feet of solid teflon hose together with the silastic peristaltic pump hose. No nutrients were detected in any of the subsampling hose blanks. Zinc was detected in one of the seven samples at a concentration of 4.0 ug/L.

Three blanks were analyzed from teflon tubing used as intake hose at the monitoring sites (Table 1.5). Each section of tubing used in the blanking process was approximately 50 feet in length. This length was selected as most representative of typical installations and provided coverage of approximately 10% of the teflon tubing cleaned for use at the monitoring sites scheduled for installation at BMP sites within District 11. No nutrients or trace metals were present in any of the samples at concentrations in excess of the reporting limits.

Blanks were analyzed from three sets of sample containers (Table 1.6). Nutrients and trace metals were below reporting limits in each set of analyses.

Blanks from a total of 14 of the 20-L borosilicate composite bottles were analyzed (Table 1.7). Total phosphorus was detected at the detection limit (0.03 mg/L) in four of the samples. Zinc was detected at 3.8 ug/L in blank water from one of the 14 composite containers. No other metals were measured in excess of reporting limits.

Method blanks for all analyses were below project reporting limits.

1.2.1.2 Holding Times

With the exception of bacteria, all samples were analyzed within holding times. In all cases, bacteria were analyzed within 24 hours but samples could not be analyzed within the desired 6-hour holding time.

1.2.1.3 Accuracy

Accuracy was assessed by use of matrix spikes, matrix spike duplicates, laboratory control samples and standard reference materials.

Matrix spikes were used for nutrients, metals and TPH. Recovery of nutrient spikes were within objectives (80-115%) during all events except the second event. Total phosphorus was 75 percent in association with analyses from this event. Spike recoveries of copper and lead were within objectives (75-125%) during all sampling events. Zinc recoveries from two of the three batches analyzed in association with the fourth event could not be calculated since the spiking concentration was 1/5th of the sample concentration. Zinc spike recoveries were below objectives in association with one of two batches analyzed during the fifth event. In that case, the concentration of the spike was roughly equivalent to the ambient concentration in the sample. Matrix spike/spike duplicates analyzed in association with TPH-diesel were extremely poor in association with samples analyzed during the second and fifth events. Severe matrix problems encountered during these two events suggest the data should be rejected.

All LCS and SRM analyses (Tables 1.9 and 1.10) were within project QA objectives.

Table 1.4 Summary of Analyses of Blank Water from Teflon Hose used for Subsampling Storm Water from the 20-L Composite Bottles

	Laboratory Batch No./Subsample Hose No.						
	T-17010			T-17325			
	16-1	16-2	16-3	16-4	16-5	16-6	16-7
Nutrients (mg/L)							
Nitrate	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U
Total Phosphorus	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U
Total Metals (ug/L)							
Copper	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Lead	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Zinc	1.0U	1.0U	1.0U	1.0U	1.0U	**4.0**	1.0U

1. "U" indicates that analyte was not detected at the associated value

Table 1.5 Summary of Analyses of Blank Water from Teflon Intake Hose installed at the Monitoring Sites

	Laboratory Batch No./Hose No.		
	T-17011	T-17085	
	HOSE-1	HOSE-2	HOSE-3
Nutrients (mg/L)			
Nitrate	0.2U[1]	0.2U	0.2U
Total Phosphorus	0.03U	0.03U	0.03U
Total Metals (ug/L)			
Copper	1.0U	1.0U	1.0U
Lead	1.0U	1.0U	1.0U
Zinc	5.0U	1.0U	1.0U
TPH (mg/L)			
TRPH	5.0U		

1. "U" indicates that analyte was not detected at the associated value.

Table 1.6 Summary of Analyses of Blank Water from Laboratory Sample Containers.

	Laboratory Batch No./Sample Container No.		
	T-16860	T-17324	
	1	SC-1	SC-2
Nutrients (mg/L)			
Nitrate	0.2U	0.2U	0.2U
TKN			
Total Phosphorus	0.03U	0.03U	0.03U
Total Metals (ug/L)			
Copper	1.0U	1.0U	1.0U
Lead	1.0U	1.0U	1.0U
Zinc	5.0U	5.0U	5.0U
TPH (mg/L)			
TRPH	5.0U		

1. "U" indicates that analyte was not detected at the associated value.

Table 1.7 Summary of Analyses of Blank Water from the 20-L Storm Water Composite Bottles.

	Laboratory Batch Number/Composite Container													
	T-16988						T-17006	T-17086				T-17323		
	20L-1	20L-2	20L-3	20L-4	20L-5	20L-6	20L-7	20L-8	20L-9	20L-10	20L-11	20L-12	20L-13	20L-14
Nutrients(mg/L)														
Nitrate	0.2U[1]	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U
Total Phosphorus	**0.03**	**0.03**	0.03U	0.03U	**0.03**	**0.03**	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U
Total Metals (ug/L)														
Copper	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Lead	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Zinc	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	**3.8**	1.0U	1.0U	1.0U	1.0U	1.0U

1. "U" indicates that analyte was not detected at the associated value

Table 1.8 Matrix Spike (MS) recovery, Matrix Spike Duplicate (MSD) recovery and Relative Percent Difference (RPD) values by Storm and Laboratory Batch.

STORM EVENT

	1			2						3			4									5					
	T-16972			T-17029			T-17030			T-17222			T-17269			T-17265			T-17258			T-17285			T-17298		
	MS[1]	MSD[2]	RPD[3]	MS	MSD	RPD	MS	MSD	RPD	MS	MSD	RPD	MS	MSD	RPD	MS	MSD	RPD	MS	MSD	RPD	MS	MSD	RPD	MS	MSD	RPD
Nutrients																											
Nitrate	104	107	2	94	95	1	101	101	1	118	116	2	107	108	1	103	102	1	103	102	1	111	111	0	106	108	2
TKN	81	86	6	98	94	4	87	86	1	98	100	2	103	102	2	103	102	2	103	102	2	106	99	7	106	99	7
Total Phosphorus	107	110	2	**75**	**75**	1	**75**	**75**	1	114	119	4	107	102	5	95	98	3	95	98	3	107	102	5	107	102	5
Total Metals																											
Copper	89	92	3	87	98	12	87	98	12	92	96	4	98	109	11	81	87	7	83	86	4	91	83	9	101	101	0
Lead	98	105	7	97	90	7	97	90	7	87	86	1	98	95	3	86	93	8	83	88	6	103	109	6	95	96	1
Zinc	81	78	4	113	115	2	113	115	2	96	100	4	107	112	5	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	**71**	**70**	1	109	112	3
TPH																			T-17257 (TPH)								
Gasoline										99	105	6							125	124	1	106	100	6			
Diesel				**36[5]**	**-28**	**200**				93	76	20							93	90	3	**16**	**-46**	**200**			
Gasoline										115	126	9															
Diesel										78	84	7															

1. MS=Matrix Spike Recovery (percent)
2. MSD=Matrix Spike Duplicate Recovery (percent)
3. RPD=Relative Percent Difference
4. Spike concentration less than three times ambient concentration. MS, MSD, and RPD not applicable.
5. Bold values indicate that values exceed QA/QC objectives

Table 1.9 Summary of Analyte Recoveries in Laboratory Control Samples (LCS). All values reported as percent recovery.

	STORM EVENTS								
	1	2		3	4			5	
	T-16972	*T-17029*	*T-17030*	T-17222	T-17269	T-17257	T-17265	T-17285	T-17298
Nutrients									
Nitrate	100	91	110	114	99	96	96	102	100
TKN	83	107	113	101	107	107	107	101	101
Total Phosphorus	96	104	104	104	99	95	95	99	99
TPH									
Gasoline	115*								
Diesel	63*	101*						100	

* LCS (maximum variation)

Table 1.10 Summary of Analyte Recoveries in Standard Reference Materials (SRM). All values reported as percent recovery.

	STORM EVENTS								
	1	2		3	4			5	
	T-16972	*T-17029*	*T-17030*	T-17222	T-17269	T-17257	T-17265	T-17285	T-17298
Conventionals[1]									
Hardness	98	98	98	100	102	102	102	102	102
TSS	101	86	86	91	91	91	91	96	96
Total Metals[2]									
Copper	95	89	89	101	94	96	96	94	97
Lead	103	84	84	94	88	92	92	86	101
Zinc	113	117	117	110	107	101	101	103	114

1. SRM = ERA 9975 (Environmental Resource Associates, WasteWatR Lot No. 9975
2. SRM = ERA 9977 (Environmental Resource Associates, WasteWatR Lot No. 9977.

Table 1.11 Summary of Relative Percent Difference (RPD) Calculations for Laboratory Duplicates by Storm and Laboratory Batch

	STORM EVENT								
	1	***2***		***3***	***4***			***5***	
	T-16972	T-17029	T-17030	T-17222	T-17269	T-17257	T-17265	T-17285	T-17298
Conventionals									
Conductivity	1	0	3	3	0	2	0	2	1
Hardness	15	4	4	8	3	3	3	15	15
TSS	0			18	0	0	0	0	0
Nutrients									
Nitrate	2	2	1	1	1	0	0	3	0
TKN	4	4	0	8	2	2	2	8	8
Total Phosphorus	0	2	2	6	5	6	6	5	5
Dissolved Metals									
Copper	1			4				0	
Lead	10			NA[1]				NA[1]	
Zinc	8			3				3	
Total Metals									
Copper	2	0	0	4		1	4	5	
Lead	3	7	7	3		5	1	0	
Zinc	5	0	0	1		3	4	4	
TPH									
Diesel		0						3	

1. Not Applicable. Both replicates were below reporting limits

Table 1.12 Summary of Relative Percent Differences between Field Duplicates.

	STORM EVENT				
	1	***2***	***3***	***4***	***5***
	T-16972	T-17029	T-17222	T-17265	T-17285
Conventionals					
Conductivity	1	5	1	3	2
Hardness	37	75	13	0	12
TSS	22	5	38	9	14
pH	1	0	3	0	0
Nutrients					
Nitrate	0	3	5	4	0
TKN	12	9	12	38[3]	20
Total Phosphorus	0	0	5	17	17
Dissolved Metals					
Copper	24	42[5]	4	13	24
Lead	54[2]	NA[1]	84[3]	NA[1]	NA[1]
Zinc	89	78	19	19	61[4]
Total Metals					
Copper	14	11	8	13	101
Lead	10	4	7	7	86
Zinc	24	18	6	8	127
TPH				T-17258 (TPH)	T-17272(TPH)
Gasoline		NA[1]			NA[1]
Diesel		13	0	22	22
BACT					
Fecal Coliform		67[6]		147	NA[1]

1. One or both values measured below reporting limits. Relative Percent Difference (RPD) not applicable.
2. Both values were less than five times the reporting limits. Difference between values was 1.1 times the RL.
3. Both values were less than five times the reporting limits. Difference between values was 1.6 times the RL.
4. One value was less than five times the reporting limits. Difference between values was 2.8 times the RL.
5. One value was less than five times the reporting limits. Difference between values was 2.4 times the RL.
6. Both values were less than five times the reporting limits. Difference between values was 1 times the RL.

1.2.1.4 Precision

Precision of analytical measurements was determined by calculation of the relative percent difference for matrix spike/spike duplicates, laboratory duplicates, and field replicates. Relative percent difference calculations based upon analysis of matrix spike/spike duplicates (Table 1.8) and laboratory replicates (Table 1.11) were all within project objectives. As expected, field replicates demonstrated far greater variability (Table 1.12).

Variability in field replicates was generally highest for dissolved metals. In most cases, this was due to concentrations that were near or below reporting limits. Dissolved zinc was an exception with moderately high and often variable concentrations among field replicates during the first two monitoring events. Precision of field replicates for total metals were within laboratory precision objectives during the first four events.

High variability occurred in field replicates of total metals during the fifth and final event of the season. Based upon good precision obtained for separate field replicates for TSS, it appears that this high variability was restricted to the samples taken for analysis of total metals. As a result, only total metals associated with the field replicate will be qualified with a "J" indicating that the values are considered estimates.

1.2.2 BMP Water Quality Results

Water quality monitoring data from all sites and events are summarized in Table 1.13. Based upon the QA/QC assessment, data qualifiers will need to be applied to portions of the data set. These qualifiers are currently not included in the data tables.

The results in Table 1.13 include data for the SR-78/I-5 Park and Ride Effluent site during the 25-26 March storm event and influent data for the SR-56/I-5 Extended Detention Basin during the 6-8 April storm event. The previous detailed review of hydrological data indicated that both of these sets could not be considered full storm composites. Failure of the primary flow monitoring equipment at the SR-78/I-5 Park and Ride Effluent site caused samples to be taken up to ten hours after flows had actually subsided. The influent data for the SR-56/I-5 Extended Detention Basin was found to represent only the rising leg of the hydrograph and therefore could not be considered a full storm composite.

1.2.3 Preliminary BMP Performance Evaluation

A preliminary evaluation of BMP performance was conducted to provide initial estimates of BMP efficiency (Table 1.14). Due to the limited number of storm events, BMP efficiencies are presented individually for each site and event. At this time, only two to four events have been sampled at each location. Calculation of lognormal statistics based upon the current data set is therefore premature.

BMP efficiencies in Table 1.14 were calculated based upon both EMCs and loads measured at the influent and effluent monitoring sites for each BMP. For purposes of these preliminary calculations, the value of the reporting limit was used in cases where an analyte was reported as undetected. Load calculations were only reported for sites where the relative percent difference between influent and effluent volumes was less than 30%. The following equation was used:

Efficiency (%) = -[(EMC in –EMC out)/EMC in] x 100

For calculation of load reductions, the calculated loads for the influent and effluent site are substituted for the EMCs. The negative sign was applied to indicate a reduction in EMCs or load as storm water passed through the BMP. Positive values indicate increases in either concentration or load.

Both extended detention basins exhibited substantial reductions in EMCs for TSS as well as total recoverable copper, lead and zinc (Table 1.14). Changes in EMCs for both nutrients and dissolved metals did not exhibit any consistent trends. On several occasions, measured EMCs increased in effluent from these BMPs.

Although BMP efficiencies were also presented for the extended detention basins on the basis of loading calculations, these estimates are considered to be less heavily biased in some cases due to the inaccuracy of low flow measurements at the sites. Other factors such as contributions from direct rainfall and runoff or possible infiltration effects may also influence differences in flow estimates between the influent and effluent sites. One extreme example is evident at SR78/I15 during the April 7-8, 1999 storm event. During this event, instrumentation indicated that effluent volumes were three times the influent volumes. Thus, flow meter volume errors introduced a strong bias when calculating changes in load between influent and effluent monitoring sites. EMC values are not as greatly affected unless the flow compositing is badly compromised. This latter factor did not appear to be serious in the present data (Figures 1.3 through 1.22)

Initial results from the perlite/zeolite media filter BMP located at the Kearny Mesa suggests that this BMP is providing only limited treatment of storm water. During the three monitored events, low to moderate (10 to 58% removal) reductions were noted in EMCs for total metals. No other constituents exhibited substantial and consistent treatment by this BMP.

BMPs installed at the La Costa Park and Ride and the SR-78/I-5 Park and Ride sites are both Type 1 Sand Media filters. Results from the initial storm events at both of these sites indicate that BMP efficiencies are being achieved (Table 1.14). EMCs for TSS, total copper, total lead, and total zinc are typically reduced by 50 to 90 percent. Dissolved zinc concentrations were reduced by 70 to 95 percent.

The BMP installed at the Escondido Maintenance Station is a Type II Sand Media filter. Initial results from this site show very little impact on suspended solids but relatively good efficiency at removing both total and dissolved zinc that occur at moderately high levels in the storm water runoff. Both total lead and, when present, dissolved lead also appears to be effectively treated in the initial storm events. Efficiency in reducing copper EMCs was less evident with much higher levels of total copper being measured in the effluent during the third event. Nutrient concentrations did not appear to be impacted substantially by passing through this sand filter. In order to evaluate flow balance at this site, the volume of the presedimentation basin (500 cubic feet) was added to the effluent volume for each event. This water slowly drained after each storm event and did not pass through the sand filter.

Table 1.13 BMP Retrofit Pilot Study, Stormwater Lab Data - District 11 (Kinnetic Laboratories Sites)

PRELIMINARY DATA

										Total (mg/L)			Dissolved (mg/L)									
Sample Date	**BMP Location**	**Site ID**	**BMP Type**	**Sampling Location**	**%Storm Capture**	**pH**	**Specific Conductance (umhos/cm)**	**Hardness (mg/L)**	**TSS (mg/L)**	**Cu**	**Pb**	**Zn**	**Cu**	**Pb**	**Zn**	**Nitrate-Nitrogen (mg/L)**	**TKN (mg/L)**	**Total P (mg/L)**	**Fecal Coliform (MPN/100 ml)**	**TPH Diesel (mg/L)**	**TPH Gasoline (mg/L)**	**TPH Oil (mg/L)**
Storm Water Matrix																						
January 25, 1999	SR56/I5-IN	111101	EDB	Influent	94	7.9	431	150	96	25	35	100	15	2.7	88	1.0	4.3	0.28	1700	380	<50	2500
January 25, 1999	SR56/I5-EFF	111101	EDB	Effluent	95	7.7	142	51	32	13	13	35	7.2	1.1	30	0.46	3.1	0.23	200	110	<50	1200
January 25, 1999	SR78/I15-IN	111102	EDB	Influent	100	8.2	75	55	120	32	30	150	11	1.5	42	0.78	2.6	0.25	700	440	<50	4300
January 25, 1999	SR78/I15-EFF	111102	EDB	Effluent	99	7.5	208	89	28	20	15	77	12	<1.0	37	1.9	4.3	0.82	400	310	<50	3600
February 5, 1999	SR56/I5-IN	111101	EDB	Influent	100	8.1	94	42	86	20	29	120	6.9	<1.0	110	0.3	1.2	0.2	200	4000	<50	---
February 5, 1999	SR56/I5-EFF	111101	EDB	Effluent	94	7.6	180	45	42	17	24	76	5.8	<1.0	17	0.38	1.4	0.21	400	2300	<50	---
February 5, 1999	SR78/I15-IN	111102	EDB	Influent	84	8.1	83	36	98	31	25	180	13	2.8	130	0.8	2.0	0.29	400	3900	<50	---
February 5, 1999	SR78/I15-EFF	111102	EDB	Effluent	95	7.7	179	58	32	17	13	98	9.3	<1.0	76	0.2	2.0	0.61	2300	2400	<50	---
March 25, 1999	SR56/I5-IN	111101	EDB	Influent	79	7.9	311	76	66	20	17	81	9.1	<1.0	24	0.53	1.1	0.26	400	1800	<500	---
March 25, 1999	SR56/I5-EFF	111101	EDB	Effluent	99.6	7.1	220	37	42	17	10	47	8.7	<1.0	25	0.34	1.1	0.19	400	1700	<500	---
March 25, 1999	SR78/I15-IN	111102	EDB	Influent	100	7.9	166	55	120	47	39	280	17	1.9	96	2.36	3.1	0.39	1100	4200	<500	---
March 25, 1999	SR78/I15-EFF	111102	EDB	Effluent	100	7.9	196	82	36	34	21	150	18	<1.0	81	1.72	2.5	0.3	2700	2800	<500	---
March 25, 1999	KearnyMS-IN	112201	MF	Influent	100	7.3	70	29	130	59	40	340	25	2.7	170	0.41	1.8	0.36	200	9300	<500	---
March 25, 1999	KearnyMS-EFF	112201	MF	Effluent	96	7.2	74	22	150	53	34	270	24	3.7	130	0.44	1.7	0.34	200	2600	<500	---
March 25, 1999	EsconMS-IN	112202	SF	Influent	100	7.1	99	29	86	33	25	500	17	2.2	200	0.77	2.8	0.4	800	3200	<500	---
March 25, 1999	EsconMS-EFF	112202	SF	Effluent	100	7.7	153	51	120	23	9.4	58	10	<1.0	38	0.95	1.9	0.49	200	1600	<500	---
March 25, 1999	LaCostaP&R-IN	112203	SF	Influent	100	6.9	83	43	42	14	8.6	110	9.7	1.1	110	0.66	2.6	0.33	<200	1300	<50	---
March 25, 1999	LaCostaP&R-EFF	112203	SF	Effluent	100	7.7	110	53	6.0	9.0	1.7	8.3	8.6	<1.0	5.2	0.69	1.8	0.28	200	2100	<50	---
March 25, 1999	SR78/I5P&R-IN	112204	SF	Influent	100	7.4	70	41	78	16	4.6	130	8.2	<1.0	65	0.29	1.8	0.41	400	1200	<500	---
March 25, 1999	SR78/I5P&R-EFF	112204	SF	Effluent	100	7.3	126	43	<1	8.3	<1	9.8	7.4	<1.0	7.7	0.97	1.3	0.24	<200	800	<500	---
April 7, 1999	SR56/I5-IN	111101	EDB	Influent	100	9.6	163	46	110	32	39	130	7.4	<1.0	32	0.43	1.4	0.3	2300	1200	<50	---
April 7, 1999	SR56/I5-EFF	111101	EDB	Effluent	100	8.0	212	48	48	18	16	69	8.9	<1.0	47	0.31	1.1	0.27	400	800	<50	---
April 7, 1999	SR78/I15-IN	111102	EDB	Influent	100	7.8	100	34	270	51	62	350	5.7	<1.0	24	0.59	2.1	0.65	1700	1000	<50	---
April 7, 1999	SR78/I15-EFF	111102	EDB	Effluent	100	7.7	170	52	38	15	13	81	8.2	<1.0	67	0.55	1.3	0.3	200	500	<50	---
April 7, 1999	KearnyMS-IN	112201	MF	Influent	100	7.4	185	46	60	51	19	230	32	2.1	150	0.42	1.9	0.18	<200	5000	<50	---
April 7, 1999	KearnyMS-EFF	112201	MF	Effluent	100	7.3	186	40	64	35	16	190	22	2.3	140	0.4	1.8	0.13	<200	700	<50	---
April 7, 1999	EsconMS-IN	112202	SF	Influent	100	6.9	62	15	220	21	28	460	5.7	<1.0	170	0.26	1.7	0.32	1300	1000	<50	---
April 7, 1999	EsconMS-EFF	112202	SF	Effluent	100	7.9	152	42	250	19	10	52	4.9	<1.0	51	0.34	1.1	0.58	200	400	<50	---
April 7, 1999	LaCostaP&R-IN	112203	SF	Influent	100	6.2	88	14	86	20	25	200	5.7	1.6	50	0.32	1.2	0.3	---	---	---	---
April 7, 1999	LaCostaP&R-EFF	112203	SF	Effluent	100	8.1	240	68	2.0	4.7	<1.0	2.6	4.0	<1.0	<2.0	0.69	1.0	0.24	---	---	---	---
April 11, 1999	SR56/I5-IN	111101	EDB	Influent	93	8.9	100	36	78	20	38	110	3.7	<1.0	30	0.25	0.9	0.44	---	---	---	---
April 11, 1999	SR56/I5-EFF	111101	EDB	Effluent	100	7.8	133	36	20	6.8	8.7	23	4.7	<1.0	16	0.21	0.8	0.19	---	---	---	---
April 11, 1999	KearnyMS-IN	112201	MF	Influent	92	7.3	68	42	34	67	26	180	20	<1.0	95	0.28	1.2	0.21	<200	7.2	<50	---
April 11, 1999	KearnyMS-EFF	112201	MF	Effluent	89	7.3	68	19	42	29	11	84	19	<1.0	82	0.26	0.8	0.44	200	2.2	<50	---
April 11, 1999	EsconMS-IN	112202	SF	Influent	87	7.0	30	10	46	18	17	250	4.1	<1.0	140	<0.20	1.2	0.21	<200	1.8	<50	---
April 11, 1999	EsconMS-EFF	112202	SF	Effluent	93	7.8	55	40	76	31	14	51	3.2	<1.0	10	<0.20	0.8	0.21	<200	1.9	<50	---
April 11, 1999	LaCostaP&R-IN	112203	SF	Influent	100	6.8	50	9.3	28	11	8	54	3.5	<1.0	45	0.28	1.5	0.17	<200	4.7	<50	---
April 11, 1999	LaCostaP&R-EFF	112203	SF	Effluent	96	7.4	108	24	6	4.1	1.3	6.4	4.1	<1.0	12	<0.20	0.9	0.17	<200	1.0	<50	---
April 11, 1999	SR78/I5P&R-IN	112204	SF	Influent	100	7.3	43	17	40	11	4.8	77	4	<1.0	31	<0.20	1.2	0.20	<200	5.1	<50	---
April 11, 1999	SR78/I5P&R-EFF	112204	SF	Effluent	100	7.5	69	18	18	18	<1.0	15	3	<1.0	7.3	0.27	1.1	0.21	<200	3.6	<50	---

NR - Not Reported. Analysis was performed to comply with holding time requirements. However, paired samples were not successfully collected.
"---" - Not Analyzed

Table 1.14 EMCs and Percent Differences in EMCs and Loads

Extended Detention Basins EMCs and BMP Efficiencies

SR56/I5

	January 25, 1999				February 5, 1999				March 25, 1999				April 7, 1999				April 11, 1999			
			Percent Difference				Percent Difference				Percent Difference				Percent Difference				Percent Difference	
	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load
TSS (mg/L)	96	32	-67	-74	86	42	-51	NC[1]	66	42	-36	-33	110	48	-56	NA	78	20	-74	-80
Total Cu (ug/L)	25	13	-48	-59	20	17	-15	NC	20	17	-15	-10	32	18	-44	NA	20	6.8	-66	-73
Total Pb (ug/L)	35	13	-63	-71	29	24	-17	NC	17	10	-41	-38	39	16	-59	NA	38	8.7	-77	-82
Total Zn (ug/L)	100	35	-65	-72	120	76	-37	NC	81	47	-42	-39	130	69	-47	NA	110	23	-79	-83
Dissolved Cu (ug/L)	15	7.2	-52	-62	6.9	5.8	-16	NC	9.1	8.7	-4	1	7.4	8.9	20	NA	3.7	4.7	27	1
Dissolved Pb (ug/L)	2.7	1.1	-59	-68	<1.0	<1.0	NA	NC	<1.0	<1.0	NA	NA	<1.0	<1.0	NA	NA	<1.0	<1.0	NA	NA
Dissolved Zn (ug/L)	88	30	-66	-73	110	17	-85	NC	24	25	4	10	32	47	47	NA	30	16	-47	-58
Nitrate-Nitrogen (mg/L)	1.0	0.46	-54	-64	0.3	0.38	27	NC	0.53	0.34	-36	-32	0.43	0.31	-28	NA	0.25	0.21	-16	-33
TKN (mg/L)	4.3	3.1	-28	-43	1.2	1.4	17	NC	1.1	1.1	0	6	1.4	1.1	-21	NA	0.9	0.8	-11	-30
Total P (mg/L)	0.28	0.23	-18	-35	0.2	0.21	5	NC	0.26	0.19	-27	-23	0.3	0.27	-10	NA	0.44	0.19	-57	-66
Volume (cubic feet)	18910	14909			8443	13307			11880	12572			NA	3442			12378	9805		

SR78/I15

	January 25, 1999				February 5, 1999				March 25, 1999				April 7, 1999			
			Percent Difference				Percent Difference				Percent Difference				Percent Difference	
	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load
TSS (mg/L)	120	28	-77	-72	98	32	-67	NC	120	36	-70	NC	270	38	-86	NC
Total Cu (ug/L)	32	20	-38	-24	31	17	-45	NC	47	34	-28	NC	51	15	-71	NC
Total Pb (ug/L)	30	15	-50	-39	25	13	-48	NC	39	21	-46	NC	62	13	-79	NC
Total Zn (ug/L)	150	77	-49	-38	180	98	-46	NC	280	150	-46	NC	350	81	-77	NC
Dissolved Cu (ug/L)	11	12	9	33	13	9.3	-28	NC	17	18	6	NC	6	8	44	NC
Dissolved Pb (ug/L)	1.5	<1.0	-93	-92	2.8	<1.0	-96	NC	1.9	<1.0	-47	NC	<1.0	<1.0	NA	NC
Dissolved Zn (ug/L)	42	37	-12	7	130	76	-42	NC	96	81	-16	NC	24	67	179	NC
Nitrate-Nitrogen (mg/L)	0.78	1.9	144	197	0.8	0.2	-75	NC	2.36	1.72	-27	NC	0.59	0.55	-7	NC
TKN (mg/L)	2.6	4.3	65	101	2.0	2.0	0	NC	3.1	2.5	-19	NC	2.10	1.30	-38	NC
Total P (mg/L)	0.25	0.82	228	299	0.29	0.61	110	NC	0.39	0.3	-23	NC	0.65	0.30	-54	NC
Volume (cubic feet)	7157	8713			3390	5660			1552	3271			4080	14894		

Media Filters (Perlite/Zeolite) EMCs and BMP Efficiencies

Kearny Mesa

	March 25, 1999				April 7, 1999				April 11, 1999			
			Percent Difference				Percent Difference				Percent Difference	
	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load
TSS (mg/L)	130	150	15	-3	60	64	7	-20	34	42	24	27
Total Cu (ug/L)	59	53	-10	-25	51	35	-31	-49	67	29	-57	-56
Total Pb (ug/L)	40	34	-15	-29	19	16	-16	-37	26	11	-58	-57
Total Zn (ug/L)	340	270	-21	-34	230	190	-17	-38	180	84	-53	-52
Dissolved Cu (ug/L)	25	24	-4	-20	32	22	-31	-49	20	19	-5	-3
Dissolved Pb (ug/L)	2.7	3.7	37	15	2.1	2.3	10	-18	<1.0	<1.0	NA	NA
Dissolved Zn (ug/L)	170	130	-24	-36	150	140	-7	-30	95	82	-14	-11
Nitrate-Nitrogen (mg/L)	0.41	0.44	7	-10	0.42	0.4	-5	-29	0.28	0.26	-7	-5
TKN (mg/L)	1.8	1.7	-6	-21	1.9	1.8	-5	-29	1.2	0.8	-33	-32
Total P (mg/L)	0.36	0.34	-6	-21	0.18	0.13	-28	-46	0.21	0.44	110	115
Volume (cubic feet)	6680	5593			1925	1438			7323	7515		

Table 1.14 EMCs and EMCs and Percent Differences in EMCs and Loads (continued)

Media Filters (Sand Type I) EMCs and BMP Efficiencies

La Costa Park and Ride	March 25, 1999				April 7, 1999				April 11, 1999			
			Percent Difference				Percent Difference				Percent Difference	
	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load
TSS (mg/L)	42	6.0	-86	-87	86	2.0	-98	-98	28	6	-79	NC
Total Cu (ug/L)	14	9.0	-36	-41	20	4.7	-77	-78	11	4.1	-63	NC
Total Pb (ug/L)	8.6	1.7	-80	-82	25	<1.0	-96	-96	8	1.3	-84	NC
Total Zn (ug/L)	110	8.3	-92	-93	200	2.6	-99	-99	54	6.4	-88	NC
Dissolved Cu (ug/L)	9.7	8.6	-11	-18	5.7	4.0	-30	-35	3.5	4.1	17	NC
Dissolved Pb (ug/L)	1.1	<1.0	-9	-16	1.6	<1.0	-38	-43	<1.0	<1.0	NA	NC
Dissolved Zn (ug/L)	110	5.2	-95	-96	50	<2.0	-96	-96	45	12	-73	NC
Nitrate-Nitrogen (mg/L)	0.66	0.69	5	-4	0.32	0.69	116	98	0.28	<0.20	-29	NC
TKN (mg/L)	2.6	1.8	-31	-36	1.2	1.0	-17	-23	1.5	0.9	-40	NC
Total P (mg/L)	0.33	0.28	-15	-22	0.3	0.24	-20	-26	0.17	0.17	0	NC
Volume (cubic feet)	1886	1736			424	390			2127	4540		

SR-78/I-5 Park and Ride	March 25, 1999				April 11, 1999			
			Percent Difference				Percent Difference	
	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load
TSS (mg/L)	78	1	-99	-98	40	18	-55	-54
Total Cu (ug/L)	16	8.3	-48	-36	11	18	64	67
Total Pb (ug/L)	4.6	<1.0	-78	-73	4.8	<1.0	-79	-79
Total Zn (ug/L)	130	9.8	-92	-91	77	15	-81	-80
Dissolved Cu (ug/L)	8.2	7.4	-10	11	4	3	-25	-24
Dissolved Pb (ug/L)	<1.0	<1.0	NA	NA	<1.0	<1.0	NA	NA
Dissolved Zn (ug/L)	65	7.7	-88	-85	31	7.3	-76	-76
Nitrate-Nitrogen (mg/L)	0.29	0.97	234	313	<0.20	0.27	35	38
TKN (mg/L)	1.8	1.3	-28	-11	1.2	1.1	-8	-7
Total P (mg/L)	0.41	0.24	-41	-28	0.20	0.21	5	7
Volume (cubic feet)	1830	2259			1910	1947		

Media Filters (Sand Type II) EMCs and BMP Efficiencies

Escondido	March 25, 1999				April 7, 1999				April 11, 1999			
			Percent Difference				Percent Difference				Percent Difference	
	Influent	Effluent	EMC	Load	Influent	Effluent	EMC	Load		Effluent	EMC	Load
TSS (mg/L)	86	120	40	-66	220	250	14	-23	46	76	65	0
Total Cu (ug/L)	33	23	-30	-83	21	19	-10	-39	18	31	72	5
Total Pb (ug/L)	25	9.4	-62	-91	28	10	-64	-76	17	14	-18	-50
Total Zn (ug/L)	500	58	-88	-97	460	52	-89	-92	250	51	-80	-88
Dissolved Cu (ug/L)	17	10	-41	-86	5.7	4.9	-14	-42	4.1	3.2	-22	-53
Dissolved Pb (ug/L)	2.2	<1.0	-55	-89	<1.0	<1.0	NA	NA	<1.0	<1.0	NA	NA
Dissolved Zn (ug/L)	200	38	-81	-95	170	51	-70	-80	140	10	-93	-96
Nitrate-Nitrogen (mg/L)	0.77	0.95	23	-70	0.26	0.34	31	-11	<0.20	<0.20	NA	NA
TKN (mg/L)	2.8	1.9	-32	-84	1.7	1.1	-35	-56	1.2	0.8	-33	-60
Total P (mg/L)	0.4	0.49	23	-70	0.32	0.58	81	23	0.21	0.21	0	-39
Volume (cubic feet)	840	204			1659	1127			2309	1402		

1. NC="Not Calculated". Load differences were not calculated for sites with influent and effluent volumes greater than 30%. For the Escondido Maintenance Station, 500 cubic feet was added to the measured effluent to account for the presedimentation chamber during each event.
2. The detection limit was used for calculations when a constituent was not detected in the storm water.
3. NA="Not Applicable". In most cases this was due to both constituents being below detection limits.

2.0 BMP Operations

2.1 Introduction and Methods

Performance assessments of BMP operations were determined using empirical observations (Form H of the OMM Volume II Field Guidance Notebooks). Empirical observations were taken 2 to 3 times per monitored event. Field crew attempted to assess BMP operations at the beginning, middle and end of a storm event. Traffic, weather and sufficient light sometimes limited these observations.

Observations generally provided information on the following:

- Present meteorological characteristics
- Rainfall (start times and intensity indication)
- Hydrologic and hydraulic characteristics (flowing and/or standing water, channelization)
- Water level
- Inlet conditions (problems affecting performance)
- Evidence of debris (organic or trash), scouring, resuspension or erosion
- Description of amount and location of sediment accumulation
- Water quality appearance (visual, olfactory)
- Vegetation condition
- Outlet conditions (problems affecting performance)
- Structural condition of facility

Other site-specific observations were taken according to the checklists present in Form H.

2.2 Summary of Empirical Observations and BMP Operations

2.2.1 Extended Detention Basins

2.2.1.1 Site 111101: I-5 / SR-56 Extended Detention Basin

The I-5/SR-56 Extended Detention Basin was turned over to KLI in mid-January. Empirical observations were first taken on January 25. From January 25 to April 29, five observations were taken during two false storms and twenty observations were taken during five events that were monitored for water quality.

Inlet Conditions

The inlet structure allowed runoff to enter the facility on every monitored event. Sediment deposition and minor resuspension was most evident at the inlet riprap. The sediments deposited at the inlet were fine sands. This sediment deposition was not significant and was undetectable in the rest of the basin outside of the inlet riprap. Standing water was usually present at the inlet riprap and the deflection berm riprap, which runs through the center of the basin. In addition, trash generally located itself at these two locations, the inlet and berm riprap. The predominant type of trash was styrofoam popcorn and cigarette butts. Trash also located itself in the northwest corner of the basin at the high waterline.

Water Quality Appearance

Runoff that entered the Extended Detention Basin at I-5/SR-56 generally had no odor. Through a storm event, floating materials ranged from none to minor amounts of trash and organic debris and sheens of oil and grease. Water colors in the basin shifted between brown and gray. The turbidity of the water was generally somewhat cloudy but transparent.

Erosion

Slight erosion from the adjacent landscape was noted on nearly every event, specifically on the south east side slope behind the paved access road. Sandbags had been placed above the road during initial construction to limit this erosion. In addition, minor erosion was noted around the side of the inlet structure. Even though the basin vegetation did not take hold, no significant erosion was noted on the basin side slopes or within the basin.

Vegetation Condition

The hydroseeded vegetation at I-5/SR-56 did not take hold and weeds have taken over on the eastern slope, while the western slope has remained barren. Even though the basin lacks vegetation, erosion is not evident on the side slopes or basin floor. The compaction of the soil is a potential reason for both the lack of vegetation and lack of erosion present at I-5/SR-56.

Outlet Conditions

Outflow flowed through the weep holes in the riser. However, in the first two monitored storm events, leakage was observed in the outlet riser from the bolts in the ladder rungs and screen gate, and the connection for the canal gate. These leaks decreased the detention of the basin. Maintenance was performed and the problem was fixed (see Section 5.0 BMP maintenance). The outlet screen also built up organic debris and trash and necessitated maintenance. It was also observed that the outlet flume had sediment deposition and required maintenance mid-way through the monitoring season.

Overall Assessment

Detention times at the I-5/SR-56 Extended Detention Basin ranged from 32.2 hours to 49.95 hours for rainfalls ranging between 0.2 and 0.66 inches. Based on empirical observations, the I-5/SR-56 Extended Detention Basin functioned as designed for the monitoring season. Small problems, such as leaks in the outlet riser and erosion on the surrounding landscape were fixed with minimal amounts of effort.

2.2.1.2 Site 111102: I-15 / SR-78 Extended Detention Basin

The I-15/SR-78 Extended Detention Basin was turned over to KLI in mid-January. Empirical observations were first taken on January 25. From January 25 to April 29, five observations were taken during two false storms and eighteen observations were taken during five events that were monitored for water quality data.

Inlet Conditions

The inlet at I-15/SR-78 functioned well during storm events. Sediment deposition was most prominent at the inlet concrete energy dissipator. But, very little resuspension was evident at the inlet during flow.

Water Quality Appearance

Runoff entering the I-15/SR-78 EDB generally had no odor, except on the 4/10 storm event a musty smell was observed. Some floating materials (mainly oil and grease sheens) were also seen in the runoff. The runoff was usually brown in color and had a turbidity of cloudy, translucent.

Erosion

Erosion seemed to be the largest problem at I-15/SR-78 during storm events. Evident in most observed storm events was erosion on the northeast basin slope above the access road. This northeast slope had an erosion control blanket, however, water continued to channelize itself. Erosion rivulets were also evident in the southwest and northwest corners of the basin, even though large sandbags protected these corners. The erosion and channelization on the side slopes was not extensive and as the vegetation goes to seed this spring, slope stabilization will increase. Nevertheless, KLI will continue to watch for slope erosion at I-15/SR-78 and the engineers will be contacted if vegetation, sandbagging or control blankets are not sufficient.

Vegetation Condition

The vegetation at I-15/SR-78 currently has 100% coverage on the basin side slopes and partial coverage of the basin floor. The vegetation appears healthy and ready to go to seed as of May 17.

Outlet Conditions

The outlet at I-15/SR-78 functioned fine during storm events. Trash deposition at the outlet was the major concern. Mainly cigarette butts and newspapers were found on the outlet screen. In addition, on one isolated storm event oil sheens were observed at the outlet structure.

Overall Assessment

Detention times at the I-15/SR-78 Extended Detention Basin ranged from 10.15 hours to 29.05 hours for rainfalls ranging between 0.23 and 0.64 inches. The basin never reached full capacity and the largest observed stage in the basin was approximately 1.0 feet at the outlet riser staff gauge. As the basin never reached capacity, these small detention times appear to be normal for the volume of water present in the EDB. Based on empirical observations, the I-15/SR-78 Extended Detention Basin functioned as designed for the monitoring season. Small problems, such as erosion on the basin side slopes will be alleviated as the vegetation increases.

2.2.1.3 Site 112208: I-5 / Manchester Ave. Extended Detention Basin

Construction of this site is not yet complete. The scheduled completion date is June 4, 1999. Wet weather observations will begin with the monitoring season starting October 1, 1999.

2.2.2 Infiltration Basin

2.2.2.1 Site 111103: I-5 / La Costa (West) Infiltration Basin

The I-5/La Costa Infiltration Basin was turned over to KLI in mid-January. Empirical observations were first taken on January 25. From January 25 to February 4, eight wet weather observations were taken at this site during two monitored events and one false alarm. In mid-February, Caltrans directed KLI to cease activities at the I-5/La Costa Infiltration Basin site.

Inlet Conditions

The inlet pipe at I-5/La Costa functioned for the first storm event on January 25, 1999. Water continually flowed out of the inlet until the basin stage read approximately 2.75 feet. At this stage, water was almost 2” from spilling onto the access road that travels around the basin. During the second monitored storm event, it was evident that flow was not occurring from the inlet because the basin stage was not increasing. Rather, it became apparent that flow was being diverted upstream by the deflection plates.

Water Quality Appearance

Runoff that entered the I-5/La Costa Infiltration Basin during the first two storm events generally had no odor, although once it was observed to have a musty odor. Trash and debris was usually present in the basin, and over time a green algae surface film began to grow. Oil and grease was not generally evident. The water color turned from colorless to brown to eventually green. Likewise, the turbidity changed from somewhat cloudy but overall transparent to cloudy translucent.

Vegetation Condition

The terrestrial hydroseed sprayed around the basin itself sprouted nicely. But, the wetland hydroseed mix, sprayed closer to Bataquitos Lagoon, struggled to establish.

Infiltration

It was observed in the first two storm events that the infiltration basin had a much slower than designed infiltration rate.

Overall Assessment

Based upon empirical observations, the I-5/La Costa (west) infiltration basin does not function as designed and retains storm water for indefinite amounts of time.

2.2.3 Media Filter (Zeolite / Perlite)

2.2.3.1 Site 112201: Kearny Mesa Maintenance Station Media Filter

The Kearny Mesa Maintenance Station Media Filter was turned over to KLI in late February. Empirical observations were first taken on March 5. Four observations were taken during dry and light rain conditions. Through March and April, twelve observations were taken during three monitored storm events.

Inlet Conditions

The inlet pipe and catch basin functioned well during storm events. However, dry weather site contamination was found to be a problem at Kearny Mesa. Post-construction, the site was cleaned and the pre-sedimentation vault was pumped of existing construction water. However, prior to monitoring and any significant rainfall, the pre-sedimentation vault was observed to be full from site contamination on March 5.

Resuspension of solids in the pre-treatment vault, the inlet bay and the cartridge bay was observed on the 4/11 storm event. This event was the only event in which any resuspension was observed.

Water Quality Appearance

The water quality runoff appearance was usually evaluated at the pre-sedimentation vault and was found to have a musty odor the majority of the time. In addition, there was usually an oil sheen and organic debris causing a yellow surface film. Occasionally, oil and grease emulsions were noted. The water in the pre-sedimentation chamber often had a turbidity of cloudy opaque. On the 4/6 storm event, the observer compared the effluent water to the pre-sedimentation water and remarked that visually, the effluent water appeared cleaner than the influent.

Media Filter

The media filter canisters did not appear to become clogged and according to empirical observations only vault 1 was used during this monitoring year. While the floors of vaults 2 and 3 were observed to be wet, no flow was ever witness from vault 1 to vault 2 and consequently from vault 2 to vault 3. The floor of vault 1 appeared to have an accumulation of sediment deposition and organic matter. The floors of vault 2 and 3 were observed to have leaf matter from nearby eucalyptus trees.

Overall Assessment

Detention times at the Kearny Mesa Media Filter ranged from 7.10 hours to 32.75 hours for rainfalls ranging between 0.23 and 0.78 inches. Based on empirical observations, the Kearny Mesa Media Filter functioned as designed for the monitoring season. No major BMP problems occurred at this site.

2.2.4 Sand Filters Type I

2.2.4.1 Site 112203: La Costa Park and Ride Sand Filter

The La Costa Park and Ride Sand Filter was turned over to KLI in late February. Empirical observations were first taken on January 25, before construction was complete. Six observation between January 25 and March 15 were taken during dry and light rain conditions. Through March and April, nine observations were taken during three monitored storm events.

Inlet Conditions

The inlet channel functioned well during the three monitored storm events. Minor debris was caught on the inlet trash grate and the Area Velocity Bubbler sensor. However, the trash did not affect monitoring or BMP functionality. Resuspension of sediment was definitely apparent where the inlet channel dumped directly into the pre-sedimentation chamber.

However, resuspension was not evident at the standpipe into the media filter chamber. Small organic debris that bypassed the stand pipe trash grate began to clog the standpipe holes and weep holes in the outlet bay. During storm events, crews manually cleaned the standpipe and a permanent fix was accomplished in mid-April.

Water Quality Appearance

Water quality appearance was generally judged by the water that was present in the pre-sedimentation basin. It was difficult to assess the odor of the water in the pre-sedimentation basin, and this difficulty was noted several times, other observations reported no odor. The pre-sedimentation chamber usually contained oil and grease, trash, organic debris and a surface film. The surface film was yellow and most likely composed of pollen from nearby vegetation. The organic debris was small pinecones and eucalyptus leaves from the surrounding trees. Oil and grease was usually present and on several occasions, the pre-sedimentation chamber was noted to have a large sheen of oil and grease. Turbidity ranged from somewhat cloudy transparent to heavy cloudy opaque.

Filter Media

It was continually noted in the empirical observations that a pool of water was generated on the eastern side of the filter media chamber. Water from the western section of the media filter chamber was also observed to slowly flow towards the eastern pool. Water that flowed toward the eastern pool flowed closely to the outlet bay riprap. Only approximately 10% of the western section of the media filter chamber was utilized and only approximately 40% of the eastern section was used during the three monitored events. Maintenance issues and ideas were discussed with the design engineers and the problem was resolved (see Section 5.0 for further details).

Overall Assessment

Detention times at the La Costa Sand Filter ranged from 23.75 hours to 80.27 hours for rainfalls ranging between 0.54 and 0.81 inches. The pre-sedimentation basin never reached full capacity and the largest observed stage in the basin was approximately 2.5 feet on the staff gauge. Based on empirical observations, the La Costa Park and Ride

Sand Filter functioned as designed for the monitoring season. The facility received runoff from the entire Park and Ride and discharged treated storm water through the normal outlet. Small problems, such as debris clogging the standpipe and water pooling in the eastern section of the media filter chamber were fixed or consulted upon.

2.2.4.2 Site 112204: I-5 / SR-78 Park and Ride Sand Filter

The I-5/SR-78 Park and Ride Sand Filter was turned over to KLI in late February. Empirical observations were first taken on March 11. Two observations were taken on false events and ten observations were taken during three monitored storm events.

Inlet Conditions

The inlet pipe functioned well during the three monitored storm events. However, sediment build up was evident during the first two storms. The inlet channel dumped directly into the pre-sedimentation chamber and resuspension of sediment was definitely apparent at this location.

Resuspension was not evident at the standpipe into the media filter chamber. However, small organic debris that bypassed the stand pipe trash grate began to clog the standpipe holes and weep holes in the outlet bay. During, storm events crews manually cleaned the standpipe and a permanent fix was accomplished in mid-April.

Water Quality Appearance

Water quality appearance was usually judged by the water that was present in the pre-sedimentation basin. It was difficult to assess the odor of the water in the pre-sedimentation basin, but most observations reported no odor. One observation made from the monitoring manhole reported no odor. The pre-sedimentation chamber usually contained trace amounts of oil and grease, trash, organic debris and a surface film. The surface film once again contained pollen and leaves. Oil and grease was usually present in trace amounts. The typical color of the runoff was brown. Turbidity ranged from usually none to cloudy translucent on two observations.

Filter Media

Water at the I-5/SR-78 Sand Filter did not localize in one location of the media filter chamber like at the La Costa Sand Filter. However, only approximately 25% of the chamber was utilized. The water gathered adjacent to the riprap and then proceeded to infiltrate through the filtration media. Maintenance issues and ideas were discussed with the design engineers and the problem was resolved (see Section 5.0 for further details).

Overall Assessment

Detention times at the I-5/SR-78 Sand Filter ranged from 19.35 hours to 21.95 hours for rainfalls ranging between 0.68 and 0.81 inches. The pre-sedimentation basin never reached full capacity and the largest observed stage in the basin was approximately 0.5 feet on the staff gauge. Based on empirical observations, the I-5/SR-78 Park and Ride Sand Filter functioned as designed for the monitoring season. The facility received runoff from the approximately 75% of the Park and Ride and discharged treated storm water through the normal outlet. Small problems, such as debris clogging the standpipe and water only utilizing 25% of the media filter chamber were fixed or consulted upon.

2.2.5 Sand Filter Type II

2.2.5.1 Site 112202: Escondido Maintenance Station Sand Filter

The Escondido MS Sand Filter was turned over to KLI in late February. Empirical observations were first taken on March 4. Three observations were taken on false events and ten observations were taken during three monitored storm events.

Inlet Conditions

The inlet pipe functioned well during the three monitored storm events. Minor sediment and trash build up (plastic bags and organic debris) occurred at the inlet flume. Suspended solids were also observed at the inlet pipe.

Water Quality Appearance

Water quality appearance was assessed in the enclosed pre-sedimentation basin. No odor was observed on the runoff entering the sand filter. In terms of floating materials, the pre-sedimentation chamber usually contained trace amounts of oil and grease in most observations. There were limited observations of trash, organic debris and surface films. Oil and grease was usually present in trace sheens. The typical color of the runoff water was brown. Turbidity ranged from none to heavy cloudy opaque on several occasions.

Filter Media

As the entire Sand Filter was enclosed, it was difficult to assess the filter media during wet weather observations. Enclosure lids were lifted in several locations along the sand filter to assess the BMP’s performance. Storm water did filter through the sand media at an indeterminable infiltration rate and the outlet was discharging. There were minor amounts of trash and organic debris observed on top of the media filter.

Overall Assessment

Detention times in the Escondido MS Sand Filter ranged from 5.98 hours to 30.82 hours for rainfalls ranging between 0.29 and 0.57 inches. Based on empirical observations, the Escondido Maintenance Station Sand Filter functioned as designed for the monitoring season. No major problems were experienced at this site.

2.2.6 Biofiltration Swales

2.2.6.1 Site 112205: SR-78 / Melrose Ave. Biofiltration Swale

The SR-78/Melrose biofiltration swale was turned over to KLI in late February. Empirical observations were first taken on January 25, prior to construction being complete. Three observations were taken on false events and six observations were taken during three monitored storm events.

Inlet Conditions

The inlet channel functioned fine during the three monitored storm events in terms of collecting runoff. Minor sediment build-up occurred at the inlet flume. Erosion on either side of the inlet channel was also observed. In addition, the flume to swale transition, which consisted of rocks glued to concrete, trapped both sediment and debris during storm events. This flume to swale transition may have a negative effect on flow monitoring at the inlet as the rocks and trapped debris may cause backwater conditions. The flume to swale transition did, however, spread the inlet water evenly over the entrance of the swale.

Water Quality Appearance

Water quality appearance of the runoff was assessed at the inlet flume. No odor was observed on the runoff entering the swale. In terms of floating materials, the runoff usually contained organic debris and trash. The typical color of the runoff water was brown or clear. Turbidity ranged from none to partially cloudy transparent.

Vegetation Condition

Vegetation at the SR-78/Melrose swale consisted of both salt grass sod and salt grass hydroseed. The northern half of the swale was laid with salt grass sod. As the sod was higher in elevation than the hydroseeded areas, flow through the swale would concentrate itself in the hydroseeded areas and runoff would flow through the southern half of the swale. Due to the concentration of flow and the lack of vegetation, erosion was apparent in the southern hydroseeded half of the swale.

Outlet Conditions

At the swale outlet, there is not an adequate transition to allow flow to become sub-critical and flow monitoring at the outlet may be difficult. Moreover, it has been observed that the exit to the outlet flume causes erosion and concrete may have to be placed to alleviate this erosion.

Overall Assessment

The SR-78/Melrose biofiltration swale was not fully operational during this monitoring year due to a lack of vegetative coverage. With the addition of healthy salt grass to the southern half of the swale, flow will become more evenly distributed. Flow monitoring problems with the inlet and outlet flumes will be discussed with the design engineers during the dry season. If an adequate transition cannot be provided at the outlet, an alternative primary device can be used.

2.2.6.2 Site 112206: I-5 / Palomar Airport Road Biofiltration Swale

Construction of this site is not yet complete. The scheduled completion date is June 30, 1999. Wet weather observations will begin with the monitoring season starting October 1, 1999.

2.2.7 Biofiltration Strips

2.2.7.1 Site 112207: Carlsbad Maintenance Station Biofiltration Strips

The Carlsbad Maintenance Station biofiltration strip was turned over to KLI in late February. Empirical observations were first taken on January 25, prior to construction being complete. Through March and April, seven observations were taken during three monitored storm events.

Inlet Conditions

During the first observed storm event, it was noted that the designed and constructed level spreader on the eastern strip localized runoff to the western end of the strip. KLI performed maintenance to the level spreader. Once this fix was in place, it was again noted that the fixed level spreader leaked on the western end. The leak on the retrofitted level spreader was caulked with 100% silicon during the dry season. Sediment and organic debris was located in the inlet level spreader following storm events.

The concrete asphalt level spreader on the western bio-strip was also observed to have two low spots and runoff concentrated itself at these two locations. However, the runoff in the low spots was not extensive during monitored events.

Water Quality Appearance

The water quality appearance entering both strips was relatively the same during monitored events. No odor was observed and floating materials sometimes consisted of oil and grease, surface films or organic debris. The oil and grease was observed during one storm event as a white emulsion. The color of the runoff ranged from clear to brown or black. During the last monitored event, a red color was observed as the trench flooded the eastern strip. Comments were made suggesting that it was from the soil. Turbidity ranged from none to cloudy translucent.

Vegetation Condition

There was not 90% coverage of the biofiltration strip at Carlsbad Maintenance Station. The non-vegetated sections of the strip received the most flow. Due to the increased flow and lack of vegetation, erosion of the strip began to occur.

Outlet Conditions

During the last storm event, it was observed that the outlet channel of the western strip was not receiving flow. Rather, flow was bypassing the channel and flowing out of the maintenance yard along the channel curb and sidewalk curb. Design engineers were notified and the problem has been rectified.

Overall Assessment

The Carlsbad Maintenance Station biofiltration strips were not fully operational during this monitoring year due to a lack of vegetative coverage. By adding complete and healthy vegetation, performing necessary maintenance to the level spreader on the eastern strip, and fixing the outlet problem on the western strip, the Carlsbad Maintenance Station biofiltration strips will be operational for the 1999/2000 monitoring year.

2.2.8 Infiltration Trench

2.2.8.1 Site 112207: Carlsbad Maintenance Station Infiltration Trench

Similar to the biofiltration strips at Carlsbad Maintenance Station, the infiltration trench was turned over to KLI in late February. Empirical observations were first taken on January 25, prior to construction being complete. Through March and April, seven observations were taken during three monitored storm events.

Inlet Conditions

As flow from the biofiltration strip was not uniformly distributed, the infiltration trench received runoff in the center of the trench. If runoff was uniformly distributed, the trench would receive flow along its eastern half.

Water Quality Appearance

Water quality appearance was impossible to assess in the monitoring well of the infiltration trench.

Infiltration

The infiltration trench never infiltrated completely during the monitoring year. The lowest stage present in the trench during empirical observation was 7.2 feet and the highest was 13.2 feet. During the highest stage, the trench overflowed back onto the eastern strip and a water color of red was observed. 13.2 feet of stage was observed to be approximately 2" inches above the monitoring well. The overflow weir was never used during this monitoring year.

Overall Assessment

Based upon empirical observations, the Carlsbad Maintenance Station infiltration trench does not function as designed and retains storm water for indefinite amounts of time.

2.2.9 Wet Basin

2.2.9.1 Site 111104: I-5 / La Costa (East) Wet Basin

Construction of this site is not yet complete. The scheduled completion date is June 3, 1999. Wet weather observations will begin with the monitoring season starting October 1, 1999.

2.3 Analysis of Empirical Data

In general, the empirical observations taken during the 1998/1999 monitoring season seem to suggest that the majority of BMPs are functioning as designed.

Inlet and outlet structures at the District 11 sites were observed to function during monitored events. Three exceptions were the I-5/SR-56 EDB, the Carlsbad Maintenance Station western biofiltration strip outlet and the Melrose Avenue biofiltration swale outlet. The outlet problems at I-5/SR-56 and the Carlsbad Maintenance Station have been fixed. Consultation with design engineers to fix the problem at the Melrose site will take place during the dry season.

Residence times at the two extended detention basins were calculated from the data logger. In order to calculate residence time, the time when flow was first monitored at the inlet was subtracted from the time at which flow ceased at the outlet. As was mentioned in the previous sections, the residence time for the I-5/SR-56 EDB ranged from 32.2 hours to 49.95 hours for rainfalls ranging between 0.2 and 0.66 inches. Detention times during the first two storm events at I-5/SR were 32.2 and 44.67 hours. These first two detention times may have been affected by leaks in the outlet riser.

Detention time at I-15/SR-78 EDB ranged from 10.15 hours to 29.05 hours. The basin never reached full capacity and the largest observed stage in the basin was approximately 1.0 feet at the outlet riser staff gauge. Flow monitoring equipment at the inlets of I-5/SR-56 and I-15/SR-78 confirmed that approximately double the volume of water was entering the I-5/SR-56 EDB as compared to the I-15/SR-78 EDB (please review hydrology data Section 1.0). The small total volume entering the I-15/SR-78 EDB was the reason for the shorter then designed detention times.

Short-circuiting of storm water runoff was observed at the Melrose Ave. biofiltration swale and the Carlsbad Maintenance Station biofiltration strips. However, these sites were not deemed operational during the 1998/1999 monitoring season because of the lack of vegetation coverage. Storm water runoff short-circuited through the non-vegetated portions of both the swale and the strips. As vegetation coverage increases during the dry season, short-circuiting through these BMPs will diminish.

Draw down times for both the infiltration basin and the infiltration trench have never been realized as both these BMP have never completely drained their storage volume. After the first two storm events in late January and early February, the infiltration basin has maintained a fairly constant stage of 2.5 feet and shows no visual evidence of draining. On the other hand, the infiltration trench has varied between 7.2 and 13.2 feet of stage throughout the storm season. Small amounts of infiltration have been observed at the trench. But, the trench has never been observed completely dry. Currently, siting studies are being conducted to determine the reasons for the poor infiltration at these two locations.

With the exception of the two infiltration BMPs and the unoperational biofiltration strips and swale, the EDBs and media filters appear to be functioning as designed based on empirical observations.

3.0 BMP AND SITE MAINTENANCE

3.1 Introduction and Methods

BMP maintenance was held to a minimum this year because of the relative young age of the majority of sites. Six of the nine sites were finished with construction in late February / early March and have only been in operation for approximately four months. The two extended detention basins and the infiltration basin have been in operation since January, yet they have only received minor maintenance during the past six months.

BMP inspections occurred on a weekly basis during extended periods of wet weather, which included the months of January-April, and after every storm monitored or those storms with more than 0.50 inch of precipitation. In the first week of May, KLI switched from weekly site inspections to monthly site inspections. These site inspections, along with empirical observations taken during storm events, were used as the basis for BMP maintenance.

Site inspections consisted of evaluating:

- Sediment/Erosion control
- Standing water
- Vegetation management
- Structural integrity
- Aesthetic concerns

3.2 Summary of Site Inspections and Maintenance Logs

3.2.1 Extended Detention Basins

3.2.1.1 Site 111101: I-5 / SR-56 Extended Detention Basin

Sediment/Erosion Control and Standing Water

Sediment deposition was not a problem at I-5/SR-56 and was limited to the inlet riprap. The sediment probes placed in three locations around the basin floor registered zero sediment deposition. The basin floor received a surface film of sediment that was only detectable because of coloration differences. The deposited sediment was dark gray and black compared to the light brown beige of the basin floor.

While erosion was not a problem within the basin, erosive conditions in the surrounding landscape contributed to inlet sediment deposition. Sandbags were placed in front of a drain leading into the basin to prevent the adjacent hillside from entering into the basin. In addition, a berm was also placed uphill of the site to prevent another adjacent slope from eroding into the basin.

Standing water was a problem at I-5/SR-56. After storm events, standing water remained in the inlet riprap and berm riprap for up to two weeks until finally dissipating. The county of San Diego Vector Control has been made aware of the problem and has visited the site on May 5, May 12 and May 19. Standing water was observed on May 5, but no mosquito or midge breeding was found.

Vegetation Management

The purpose of the vegetation at I-5/SR-56 was as an erosion control measure. This vegetation has not taken hold and weeds have taken over approximately 40% of the basin with the other 60% remaining barren. Even without vegetation, there has been no erosion of the basin slopes or floor. The basin's soil is highly compacted and this may be the reason that the hydroseeded vegetation could not establish and erosion has not occurred. It is conceivable that weeding the site may cause future erosion. Therefore, KLI weed whipped the existing weeds to 8 inches to halt further weed dispersal. The soil will be tested in the dry season to assess if the site should be re-hyrdroseeded with the same or a different seed mix in accordance with the Maintenance Indicator Document.

Structural Integrity

The only problems associated with structural integrity were with regards to the outlet riser. It was observed on the first two storm events that the outlet riser leaked around the bolts of the ladder rungs, and the connection for the canal gate. KLI used 100% silicon caulk and caulked around the bolts to eliminate the leaks. A minor amount of rust was also observed in the outlet riser.

There was slight sediment accumulation in front of the effluent Palmer-Bowlus flume. This flume was cleaned once mid-way through the monitoring season.

Aesthetic Concerns

Trash accumulation was the only aesthetic concern at I-5/SR-56. The site was cleared of trash approximately once every two months. Trash collection took one person 30 minutes to complete.

3.2.1.2 Site 111102: I-15 / SR-78 Extended Detention Basin

Sediment/Erosion Control and Standing Water

As mentioned in Section 2.2.1.2, erosion was a slight problem at I-15/SR-78. Erosion was evident on the northeast basin slope above the access road. This northeast slope had an erosion control blanket, however, water continued to channelize itself.

Erosion rivulets were also evident in the southwest and northwest corners of the basin, even though large sandbags protected these corners. The erosion and channelization on the side slopes was not extensive and as the vegetation goes to seed this spring, slope stabilization will increase. Nevertheless, KLI will continue to watch for slope erosion at I-15/SR-78 and the engineers will be contacted if vegetation, sandbagging or control blankets are not sufficient.

Apart from erosion, alluvial sediment deposits were created at the inlet concrete energy dissipator. These alluvial deposits were not significant enough to cause ponding and were not raked out. Sediment deposition was most prevalent at the inlet. In addition, a surface film of dark sediment was seen through out the basin, mainly in the trench leading to the outlet riser. This surface film was relatively undetectable to the sediment probes placed in three locations throughout the basin floor. Sediment deposits in the basin measured less than 1/16" inch.

Standing water was a minor issue at the outlet. The outlet riser holes were higher than the area directly around the outlet. A small pool of water, less than ¼" inch, was observed after storm events, but dissipated within a week of the event. Vector control has visited the site on May 5 and May 19 and no standing water was observed.

Vegetation Management

The vegetation at I-15/SR-78 currently has 100% coverage on the basin side slopes and partial coverage of the basin floor. The vegetation appears healthy and ready to go to seed as of May 17. In order not to disturb the seeding of the desired vegetation, KLI weeded all undesirable plants that were above 18" inches in height.

Structural Integrity

The structural integrity of the site is fairly sound. An animal burrow was observed near the inlet structure on the side slope, but it does not affect the stability of the slope. The outlet riser only had to be cleaned of organic debris and trash once and it took approximately 15 minutes.

Aesthetic Concerns

The only aesthetic concerns at the site were trash and debris. Trash and debris were collected approximately once every two months. Collection took approximately 45 minutes due to the large size of the BMP.

3.2.1.3 Site 112208: I-5 / Manchester Ave. Extended Detention Basin

Construction of this site is not yet complete. The scheduled completion date is June 4, 1999. Monthly maintenance inspections will begin when construction of the BMP has been completed.

3.2.2 Infiltration Basin

3.2.2.1 Site 111103: I-5 / La Costa (West) Infiltration Basin

Sediment/Erosion Control and Standing Water

Due to the standing water at the Infiltration Basin, it was impossible to observe sediment deposition into the basin.

Erosion at the Infiltration Basin was not a significant problem.

After the first rains of the year, approximately 2.5 feet of water remained in the basin. KLI observed a mosquito on February 2 and the San Diego County Vector Control was contacted. Vector control found evidence of chironomid midge emergence and breeding (i.e. larvae, pupae, and cast pupal skins). One second instar mosquito larva was dipped and identified as *Culex pipiens*. Vector control stocked the pond with mosquito fish and treated with Altosid.

Vegetation Management

During the brief period of maintenance activity, the vegetation within and around the basin was taking hold.

Structural Integrity

The structural integrity of the site was sound. Throughout the wet season, the basin never overflowed.

Aesthetic Concerns

The only aesthetic concerns at the Infiltration Basin were with regards to trash and debris. Trash and debris were collected twice at the La Costa infiltration basin and both collections took approximately 15 minutes.

3.2.3 Media Filter (Zeolite / Perlite)

3.2.3.1 Site 112201: Kearny Mesa Maintenance Station Media Filter

Sediment/Erosion Control and Standing Water

It was extremely difficult to assess sediment deposition in the pre-sedimentation chamber because the chamber was constantly submerged in no less than 21.5” inches of water. Sediment deposition in the pre-sedimentation chamber will be evaluated during the dry season. In vault 1 there was an organic sludge deposited on the floor ¼” thick, and a thin surface film of organic sludge in vault 2.

Erosion was not a problem at the Kearny Mesa media filter.

Standing water was a problem at the media filter. The pre-sedimentation chamber and the inlet bay always had approximately 21.5” inches of standing water. In addition, the troughs below the energy dissipators always had approximately 5” inches of standing water present in them. Vector Control has been made aware of the problem and on May 5, 12, and 19, they inspected the site. On all three occasions, approximately 2 feet of water was found in the pre-sedimentation vault. The inlet bay had about 2 feet of water before the baffle. The second and third vaults had standing water in the troughs below the trash grates. No mosquito breeding was noted.

In addition to standing water, raccoon tracks were found on the effluent flume on April 9.

Filter Media

When the media filter, zeolite and perlite, was brand new, it had the appearance of white styrofoam. After the last event, it was noticed that the media filter in the first vault had a brown color. The first vault also had approximately ¼” of organic sludge and the trash gates to the vaults were filled with organic debris. On April 26, KLI cleaned out the organic debris from the trash grates; it took approximately 15 minutes.

Structural Integrity

The structure of the Kearny Mesa media filter is sound.

Aesthetic Concerns

There are no real aesthetic concerns at Kearny Mesa; the majority of debris is organic (i.e. leaves and acorns).

3.2.4 Sand Filters Type I

3.2.4.1 Site 112203: La Costa Park and Ride Sand Filter

Sediment/Erosion Control and Standing Water

Sediment deposition was evident in the pre-sedimentation chamber. At the end of the monitoring season, surface films of sediment deposits were present in the chamber. This sediment deposition was no greater than 1/8 of an inch in any one location and was significantly below maintenance thresholds.

Erosion was not an issue at the La Costa Park and Ride sand filter.

Standing water was a minor issue at the La Costa sand filter. After the first monitored storm event, it was realized that the stand pipe alone could not drain the pre-sedimentation chamber. After an event, approximately 1-2" inches of standing water remained. To alleviate this problem, KLI consulted with the design engineers and upon their approval KLI drilled 3/8" weep holes in the drain plugs so that the pre-sedimentation basin could completely drain. In addition to standing water in the pre-sedimentation basin, minor amounts of standing water (less than 1 gallon) were found in three areas below the drain plug pipes and canal gate in the outlet bay. Vector Control sampled this water on May 5 and May 12, and found that the water was breeding chironomid larvae in insignificant numbers. By May 19, the standing water had evaporated.

A killdeer, *Charadrius vociferus*, a common bird, was found to be nesting along side the entrance gate to the BMP in mid April. This bird is protected under the Migratory Bird Act and crews avoided the nest until it became unoccupied in late May.

Filter Media

During wet weather empirical observations, it was noted that the entire media filter chamber was not being utilized. In addition, water seemed to flow towards the eastern side of the media chamber. KLI consulted with the design engineers who in turn contacted the City of Austin. The City of Austin said that it was normal for the sand filter not to use the entire chamber during the first several events. After normal sediment loading occurred, the entire media chamber would be utilized.

Structural Integrity

During and after storm events, it was observed that the PVC holes in the standpipe became inundated and clogged with organic debris. The trash grates installed over the standpipe had too large of a mesh to stop the organic debris from clogging the PVC holes. Therefore, in mid-April, KLI installed finer stainless steel mesh over the existing trash grate by using industrial cable ties.

Aesthetic Concerns

The only aesthetic concerns at the La Costa sand filter were with regards to trash and debris. Trash was primarily located in the pre-sedimentation chamber and consisted mainly of plastic bags, cups and cigarette butts. Trash and debris were collected once every other month at the La Costa sand filter. Trash collection occurred most often in the pre-sedimentation basin and took approximately 30 minutes.

3.2.4.2 Site 112204: I-5 / SR-78 Park and Ride Sand Filter

Sediment/Erosion Control and Standing Water

Sediment deposition was evident in the pre-sedimentation chamber at I-5/SR-78 Park and Ride sand filter. At the end of the monitoring season, surface films of sediment deposits were present in the chamber. This sediment deposition was no greater than 1/8 of an inch in any one location and was significantly below maintenance thresholds. In addition to sediment deposition in the pre-sedimentation chamber, there was also significant sediment build-up at the inlet pipe before the low flow Palmer-Bowlus flume. The inlet pipe was cleaned twice, once after each of the first two monitored events. It was discovered that the sediment was originating from the pipe leading into the inlet pipe. Sediment build-up in the inlet pipe was not a problem after the first two monitored events.

There was slight erosion on the landscaping on the southern side of the BMP. Due to irrigation and runoff, erosion caused a sediment build-up around the junction manhole near the monitoring security enclosure. KLI has cleared away this sediment.

On May 19, Vector Control found approximately 1” of water covering the floor of the pre-sedimentation basin. There were significant numbers of adult midges noted on the walls of both chambers but no larvae or pupae were noted; no treatment was performed. In addition to standing water in the pre-sedimentation basin, minor amounts of standing water (less than 1 gallon) were found in the area below the canal gate in the outlet bay. Vector Control sampled this water on May 5, and found that the water was breeding chironomid larvae in insignificant numbers.

Filter Media

During wet weather empirical observations, it was noted that the entire media filter chamber was not being utilized. KLI consulted with the design engineers who in turn contacted the City of Austin. The City of Austin said that it was normal for the sand filter not to use the entire chamber during the first several events. After normal sediment loading occurred, the entire media chamber would be utilized.

Structural Integrity

During and after storm events, it was observed that the PVC holes in the standpipe became inundated and clogged with organic debris. The trash grates installed over the standpipe had too large of a mesh to stop the organic debris from clogging the PVC holes. Therefore, in mid-April, KLI installed finer stainless steel mesh over the existing trash grate by using industrial cable ties.

Aesthetic Concerns

The only aesthetic concerns at the I-5/SR-78 sand filter were with regards to trash and debris. Trash was primarily located in the pre-sedimentation chamber and consisted mainly of plastic bags, cups and cigarette butts. Trash and debris were collected once every other month at the I-5/SR-78 sand filter. Trash collection occurred primarily in the pre-sedimentation basin and took approximately 30 minutes.

3.2.5 Sand Filter Type II

3.2.5.1 Site 112202: Escondido Maintenance Station Sand Filter

Sediment/Erosion Control and Standing Water

It was extremely difficult to assess sediment deposition in the pre-sedimentation chamber at the Escondido Maintenance Station because the chamber was constantly submerged in several inches of water. Sediment deposition in the pre-sedimentation chamber will be evaluated during the dry season. Very small amounts of sediment deposition were observed on the filter media after the last event. Approximately 1/32” of an inch was located in sporadic locations near the pre-sedimentation chamber.

No erosion was observed at the Escondido Maintenance Station.

Standing water was an issue at the Escondido Maintenance Station because the pre-sedimentation basin did not drain completely between storm events. The County of San Diego Vector Control has been made aware of this problem. This site was inspected on May 5 and May 19. On both occasions, the pre-sedimentation basin was found to be holding approximately 12” inches of standing water. There was no evidence of mosquito breeding or midge breeding and no vertebrate problems were noted.

Filter Media

No major problems have been noted with the filter media except very slight sediment deposition. One plant and two grass roots were weeded from the filter media.

Structural Integrity

A very small leak in the pre-sedimentation basin canal gate causes the basin to slowly drain. The problem was brought forth to the design engineers and it was decided that the small leak did not significantly affect BMP performance. A concrete parking block was also partially damaged when a vehicle drove over it.

Aesthetic Concerns

The only aesthetic concerns at the Escondido MS Sand Filter were with regards to trash and debris. Trash was located in both the pre-sedimentation chamber and the filter media and consisted mainly of plastic bags, cups and organic debris. Trash and debris were collected once every other month at the Escondido MS sand filter. Trash collection occurred primarily in the pre-sedimentation basin and took approximately 15 minutes.

3.2.6 Biofiltration Swales

3.2.6.1 Site 112205: SR-78 / Melrose Ave. Biofiltration Swale

Sediment/Erosion Control and Standing Water

There was minor sediment deposition at both the inlet and outlet flumes. These flumes were cleaned once during the monitoring season. There was also extensive organic debris (eucalyptus leaves) and trash present in the flume to swale transition that was cleaned out once during the monitoring season. Cleaning out the flumes and the transition took approximately 15 minutes.

There was minor erosion present around the inlet channel. Also, there was erosion in the non-vegetated sections of the swale. Erosion was also present in the area located at the exit of the outlet flume. The erosive conditions at the inlet and swale will lessen as the salt grass begins to take coverage. KLI will discuss options for erosion control at the exit of the outlet flume with the design engineers.

Standing water was not an issue at the SR-78/Melrose bio-swale.

Vegetation Management

Vegetation management at the site consisted of weeding, mowing and debris removal. Organic debris (leaves, bark, and acorns) in the swale were a constant problem because of the close proximity of eucalyptus trees. In order to prepare the site to be re-hydroseeded on April 28, the swale was hand weeded and the surrounding slopes were weed whipped on April 27. It took approximately 57 man-hours to weed and mow the SR-78/Melrose site on this occasion. The SR-78/Melrose site will be weeded and organic debris will be removed once again in June.

Structural Integrity

On several site inspections, a burrow was observed on the northern slope. After discussions with Caltrans, it was decided that the burrow did not pose a threat to the stability of the slope. Other then the burrow, the structural integrity of the site is sound.

Aesthetic Concerns

The only aesthetic concerns at the SR-78/Melrose swale were with regards to trash and debris. Trash was located throughout the swale. Trash and debris were collected once every other month at the Melrose swale. Trash collection took approximately 15 minutes.

3.2.6.2 Site 112206: I-5 / Palomar Airport Road Biofiltration Swale

Construction of this site is not yet complete. The scheduled completion date is June 30, 1999. Monthly maintenance inspections will begin when construction of the BMP has been completed.

3.2.7 Biofiltration Strips

3.2.7.1 Site 112207: Carlsbad Maintenance Station Biofiltration Strip

Sediment/Erosion Control and Standing Water

During the first monitored storm events, it was observed that the level spreader at the eastern strip caused water to only spread over the western most section of the strip. The problem was discussed with the design engineer and it was determined that the lack of vegetation did not provided enough resistance to cause the level spreader to back up and spread water over the entire strip. KLI retrofitted the site with irrigation strips that leveled the level spreader.

Minor sediment deposition was apparent at the eastern bio-strip's retrofitted level spreader. This level spreader was cleared of organic debris once and it took approximately 15 minutes.

The lack of vegetation caused minor erosion in both the eastern and western strips.

Standing water occurred after every storm event in the eastern level spreader. A small leak at the western end of the level spreader allowed the standing water to flow onto the strip and infiltrate or dissipate. This leak was caulked with 100% silicon caulk and it is anticipated that this level spreader will be dismantled when the vegetation at the eastern strip has taken hold.

Vegetation Management

Vegetation management at the Carlsbad Maintenance Station consisted of weeding, mowing and debris removal. Organic debris (leaves, bark, and twigs) in the strip was a problem because of surrounding trees and shrubs. Minor weeding occurred at the site on May 17 for an hour. The next scheduled landscape maintenance will consist of hand weeding all plants except salt grass, replacing soil divots and removing organic debris.

Structural Integrity

During empirical observations, it was observed that the outlet channel on the western strip did not receive a large percentage of the runoff. Rather, runoff followed the outlet channel curb to the sidewalk curb and left the Maintenance Station without entering the outlet channel. The design engineers were consulted and a temporary fix was discovered. Three sandbags were placed on the western end of the strip, adjacent to the sidewalk curb. These sandbags forced water over the outlet curb and normal flow occurred. A more permanent concrete fix will be implemented during the dry season.

Aesthetic Concerns

There were no major aesthetic concerns at the Carlsbad Maintenance Station.

3.2.8 Infiltration Trench

3.2.8.1 Site 112207: Carlsbad Maintenance Station Infiltration Trench

Sediment/Erosion Control and Standing Water

Sedimentation was a minor problem at the strip/trench interface. Minor deposits of sediment were observed on the infiltration gravel adjacent to the strip. However, infiltration and flow did not appear to be disrupted at the interface and it was decided not to wash the infiltration gravel.

Structural Integrity

The structural integrity of the infiltration trench was sound.

Aesthetic Concerns

There were no major aesthetic concerns at the Carlsbad Maintenance Station.

3.2.9 Wet Basin

3.2.9.1 Site 111104: I-5 / La Costa (East) Wet Basin

Construction of this site is not yet complete. The scheduled completion date is June 3, 1999. Monthly maintenance inspections will begin when construction of the BMP has been completed.

3.3 Analysis of the Maintenance Program

In order to assess the 1998/1999 Maintenance Program, the BMP maintenance threshold document was used as the OMM manual's planned maintenance. Small deviations from the threshold document are noted below. It is difficult and slightly premature to make comparisons between actual maintenance activities and the planned threshold maintenance because of the short amount of time the sites have been in operation.

Vegetation management at the I-5/SR-56 extended detention basin did not follow the parameters in the maintenance threshold document because of site specific considerations. Weeds were not pulled at the basin because pulling these weeds could foster erosive conditions on the basin side slopes. Rather, KLI weed whipped the existing weeds to 8 inches to halt further weed dispersal.

Apart from vegetation management at I-5/SR-56 and trash collection frequency at all BMP sites, the maintenance threshold document was adhered to at the District 11 BMPs.

4.0 DESIGN AND CONSTRUCTION EVALUATION

The design and construction evaluation is a field assessment of the operation of the District 11 BMP sites. Any problems observed during field operations that were the result of design and/or construction are noted in this section. Over 200 field inspections and observations were taken at 9 BMP sites throughout the 1998/1999 monitoring season. These observations revealed that for the most part, the District 11 BMP sites functioned as designed and constructed, only several minor problems with six of the nine monitored sites are noted in this section.

Extended Detention Basins

A design problem noted at the two extended detention basins (I-15/SR-78 and I-5/SR-56) was with regards to the manhole covers. Manhole covers at the two extended detention basins are both heavy and unwieldy. As maintenance crews frequently have to observe inlet and outlet pipe conditions, removing the manhole covers becomes an unnecessarily dangerous burden. Where manholes are not in the middle of access roads, as is the case at the I-5/SR-56 EDB, lighter manhole covers should be used to allow maintenance crews easy accessibility.

Another design problem is the use of riprap as an inlet energy dissipator and as a deflection berm. This riprap traps water and is a potential breeding site for vectors.

As previsouly noted, a minor construction problem was also that the outlet riser leaked.

Sand Filters Type I

A design problem observed at both the La Costa Park and Ride and the I-5/SR-78 Park and Ride Sand Filters was the mesh size of the trash grates at the pre-sedimentation chamber standpipes. The mesh size on these stainless steel trash grates was over five times the area of the holes drilled into the PVC standpipe. Therefore, organic debris and trash were able to clog the standpipe holes. KLI retrofitted the trash grates with stainless steel mesh that was smaller than the holes in the standpipe.

At the La Costa sand filter, the current design of the standpipe creates 1-2” inches of standing water because the holes on the PVC pipe do not come flush with the floor of the pre-sedimentation chamber. KLI drilled weep holes in the drain plugs on either side of the standpipe to allow the pre-sedimentation chamber to drain completely.

At the I-5/SR-78 sand filter, the manholes at the outlet are depressed into the surrounding hillside. Erosion around the manholes has caused sediment to build up. These manholes should be raised in order to avoid the sedimentation build-up over the covers. The manhole rings are also beginning to crack away and deteriorate at an accelerated pace.

Moreover, the influent/effluent monitoring manhole covers at I-5/SR-78 did not have a hole for a manhole jack and KLI drilled one out. The effluent monitoring manhole cover is also made of galvinized steel and the stainless steel manhole cover has been incorrectly placed at the pipe junction. KLI has attemtped to switch these two covers, but the covers and the rings vary in size, so exchanging the two covers is impossible.

Sand Filter Type II

A construction problem noted at the Escondido Maintenance Station sand filter type II was that the canal gate for the pre-sedimentation chamber had a small leak. This small leak was determined not to have a negative impact on BMP performance.

Media Filter (Perlite / Zeolite)

Site inspections at the Kearny Mesa Maintenance Station Media Filter revealed that troughs beneath the vault energy dissipators trapped approximately 5” inches of standing water. These designed troughs appeared to serve no purpose except to retain water. Future designs may want to eliminate these troughs from the media filter vaults if they are nonessential. In addition, the current design of the pre-sedimentation chamber allows up to 22” inches of standing water. There is no way to drain this standing water from the pre-sedimentation chamber. A canal gate should be installed on future pre-sedimentation chambers to drain these chambers if necessary.

Biofiltration Strip / Infiltration Trench

A design problem noted at the Carlsbad Maintenance Station biofiltration strip/infiltration trench was that the level spreader at the eastern strip caused water to only be spread over the western most section of the strip. The problem was discussed with the design engineer and it was determined that the lack of vegetation did not provided enough resistance to cause the level spreader to back up and spread water over the entire strip. KLI retrofitted the site with irrigation strips that leveled the level spreader. As previously mentioned, the western biofiltration strip was designed or constructed in such a way that the outlet channel could not receive low flow.

APPENDIX D:

STORMWATER QUALITY SUMMARY TABLES

MW/LAW CRANDALL MONITORING SITES (DISTRICT 7)

	Site ID: 073216			Site ID: 073216			Site ID: 073217			Site ID: 073217			Site ID: 073218			Site ID: 073218		
	Foothill MS, north CBI monitoring station (effluent from StreamGuard Insert)			Foothill MS, south CBI monitoring station (effluent from Fossil Filter Insert)			Las Flores MS, north CBI monitoring station (effluent from StreamGuard Insert)			Las Flores MS, south CBI monitoring station (effluent from Fossil Filter Insert)			Rosemead MS, north CBI monitoring station (effluent from Fossil Filter Insert)			Rosemead MS, south CBI monitoring station (effluent from StreamGuard Insert)		
Date of Storm Event	Sampled	Observations	Total Precipitation	Sampled (6)	Observations	Total Precipitation	Sampled	Observations	Total Precipitation	Sampled (6)	Observations	Total Precipitation	Sampled (6)	Observations	Total Precipitation	Sampled	Observations	Total Precipitation
25-Jan-99	(1)	●	0.49	●	●	0.49	(1)	●	0.25	(1)	●	0.25		●	0.41		●	0.41
31-Jan-99	(2)		0.35	(2)		0.35	(1)	●	0.48	●	●	0.48	(1)	●	0.42	●	●	0.42
9-Feb-99		●	0.54		●	0.54		●	0.29	●	●	0.29	(1)	●	0.44	●	●	0.44
21-Feb-99	LawCrandall mobilized for a predicted storm event--it did not occur.																	
11-Mar-99	LawCrandall mobilized for a predicted storm event--it did not occur.																	
15-Mar-99	(3)	●	0.52	(3)	●	0.52	(3)	●	0.81	(3)	●	0.81	(3)	●	0.52	(3)	(4)	0.52
19/20-Mar-99	(3)	●	0.16	(3)	●	0.16	(3)	●	0.38	(3)	●	0.38	(3)	●	0.18	(3)	(4)	0.18
25-Mar-99	●	●	0.26	●	●	0.26	●	●	1.00	●	●	1.00	●	●	0.23	●	●	0.23
6-Apr-99	●	●	1.16	●	●	1.16	●	●	1.02	(5)	●	1.02	●	●	1.22	●	●	1.22
11/12-Apr-99	●	●	1.01	●	●	1.01	●	●	1.39	●	●	1.39	●	●	0.78	●	●	0.78

Total Events Sampled	4	4	5	5	5	5

(1) Sample collected and analyzed; percent storm capture below 70%.
(2) Inserts were removed in accordance with the OMM Plan and were in the process of being replaced.
(3) No samples collected (lack of monitoring staff due to last minute mobilization).
(4) No catch basin insert. StreamGuard Insert removed per direction of Caltrans.
(5) Not sampled due to equipment problem.
(6) Samples obtained at the sites with Fossil Filter Insert have been tentatively disqualified for storm events prior to the March 25 event (pending review of water quality data).

Note:
Visual observation of the Fossil Filter inserts indicate stormwater bypass (overflow) during low flow conditions.
Stormwater bypass occurred despite removing debris from the top of the adsorbent filter cartridge.
Visual observations of sediment in the downstream monitoring vaults indicate that sediment is bypassing both the Fossil Filter and StreamGuard inserts.
Dry weather induced flow testing at Rosemead Maintenance Station was conducted on 9 March 1999.
At Foothill MS, Rosemead MS, and Las Flores MS, each Fossil Filter and StreamGuard insert was replaced on 24 March 1999.
At Foothill MS, each Fossil Filter and StreamGuard insert was replaced on 8 April 1999 in accordance with the monitoring plan.
At Foothill MS, each Fossil Filter and StreamGuard insert was replaced on 12 April 1999 in accordance with the monitoring plan.

PRELIMINARY DATA
Submitted 5/25/99

BMP Retrofit Pilot Study, Stormwater Lab Data - District 7 (Law Crandall Sites)

Sample Date	BMP Location	Site ID	BMP Type	Sampling Location	% Storm Capture	pH	Specific Conductance (umhos/cm)	Hardness (mg/L)	TSS (mg/L)	Total (µg/L) Cu	Total (µg/L) Pb	Total (µg/L) Zn	Dissolved (µg/L) Cu	Dissolved (µg/L) Pb	Dissolved (µg/L) Zn	Nitrate-Nitrogen[1] (mg/L)	TKN[1] (mg/L)	Total P[1] (mg/L)	Fecal Coliform (MPN/100mL)	TPH Diesel (µg/L)	TPH Gasoline (µg/L)	TPH Oil (µg/L)
Storm Water Matrix																						
January 25, 1999	Foothill Maintenance Station	073216	Drain Inlet Insert - StreamGuard	Effluent	58	6.8	45	13	38	17	12	140	9.8	0.93	95	—	—	—	—	310	560	290
January 25, 1999	Foothill Maintenance Station	073216	Drain Inlet Insert - Fossil Filter	Effluent	93	7.1	48	20	38	17	17	160	10	1.2	87	—	—	—	—	250	<50	350
January 25, 1999	Las Flores Maintenance Station	073217	Drain Inlet Insert - StreamGuard	Effluent	50	6.8	150	40	50	29	4.9	120	22	<0.50	83	—	—	—	—	760	<50	630
January 25, 1999	Las Flores Maintenance Station	073217	Drain Inlet Insert - Fossil Filter	Effluent	16	7.3	68	27	90	11	6.6	220	4.8	0.50	78	—	—	—	—	370	<50	240
January 31, 1999	Las Flores Maintenance Station	073217	Drain Inlet Insert - StreamGuard	Effluent	99	6.7	140	60	220	30	15	130	10	<0.50	30	—	—	—	—	420	<50	360
January 31, 1999	Las Flores Maintenance Station	073217	Drain Inlet Insert - Fossil Filter	Effluent	99	6.8	115	36	58	12	4.9	140	7.2	<0.50	85	—	—	—	—	710	<50	370
January 31, 1999	Rosemead Maintenance Station	073218	Drain Inlet Insert - StreamGuard	Effluent	99	6.9	46	16	50	15	25	150	6.6	1.2	79	—	—	—	—	340	<50	210
January 31, 1999	Rosemead Maintenance Station	073218	Drain Inlet Insert - Fossil Filter	Effluent	89	7.2	47	15	42	15	16	180	6.8	1.5	110	—	—	—	—	210	<50	120
February 9, 1999	Las Flores Maintenance Station	073217	Drain Inlet Insert - Fossil Filter	Effluent	99	9.2	155	58	80	11	7	87	5.1	<0.50	<5.0	—	—	—	—	270	<50	250
February 9, 1999	Rosemead Maintenance Station	073218	Drain Inlet Insert - StreamGuard	Effluent	99	7.4	110	35	100	20	36	165	8.5	0.97	59	—	—	—	—	410	89	200
February 9, 1999	Rosemead Maintenance Station	073218	Drain Inlet Insert - Fossil Filter	Effluent	35	7.6	64	51	320	59	110	820	4.2	0.72	41	—	—	—	—	140	<50	110
March 25, 1999	Foothill Maintenance Station	073216	Drain Inlet Insert - StreamGuard	Effluent	81	6.9	41	11	4	8.3	2.6	96	6.9	0.50	87	0.67	1.49	0.06	—	290	54	240
March 25, 1999	Foothill Maintenance Station	073216	Drain Inlet Insert - Fossil Filter	Effluent	79	7.1	130	33	34	20	16.0	160	12	0.68	86	0.74	1.68	0.10	—	390	240	430
March 25, 1999	Las Flores Maintenance Station	073217	Drain Inlet Insert - StreamGuard	Effluent	32	6.7	110	38	60	18	4.8	49	12	<0.50	21	0.45	1.05	0.13	—	340	<50	230
March 25, 1999	Las Flores Maintenance Station	073217	Drain Inlet Insert - Fossil Filter	Effluent	83	6.9	53	20	80	12	7.0	93	4	<0.50	26	0.38	0.86	0.10	—	270	<50	260
March 25, 1999	Rosemead Maintenance Station	073218	Drain Inlet Insert - StreamGuard	Effluent	99	6.9	76	29	82	32	50	280	18	2.2	120	0.96	2.67	0.20	—	590	460	480
March 25, 1999	Rosemead Maintenance Station	073218	Drain Inlet Insert - Fossil Filter	Effluent	80	7.4	74	27	44	18	20	160	11	2.7	89	0.81	1.22	0.09	—	420	240	670
April 6, 1999	Foothill Maintenance Station	073216	Drain Inlet Insert - StreamGuard	Effluent	34	7.1	98	23	36	25	10	275	14	0.61	180	0.98	2.45	0.10	—	460	62	200
April 6, 1999	Foothill Maintenance Station	073216	Drain Inlet Insert - Fossil Filter	Effluent	97	7.1	30	17	78	23	43	225	5.3	0.72	54	0.43	1.27	0.15	—	190	66	180
April 6, 1999	Las Flores Maintenance Station	073217	Drain Inlet Insert - StreamGuard	Effluent	74	6.7	105	38	72	19	5.9	62	13	<0.50	33	1.1	1.52	0.21	—	380	<50	350
April 6, 1999	Rosemead Maintenance Station	073218	Drain Inlet Insert - StreamGuard	Effluent	83	7.1	54	23	68	22	37	265	9.8	0.97	130	0.52	1.53	0.14	—	250	77	260
April 6, 1999	Rosemead Maintenance Station	073218	Drain Inlet Insert - Fossil Filter	Effluent	68	7.5	130	59	130	59	110	460	12	4.7	120	0.71	2.62	0.24	—	330	<50	300
April 12, 1999	Foothill Maintenance Station	073216	Drain Inlet Insert - StreamGuard	Effluent	61	7.0	25	<7.0	6	5.4	4.6	73	3.2	<0.50	54	0.34	2.4	0.181	—	160	<50	98
April 12, 1999	Foothill Maintenance Station	073216	Drain Inlet Insert - Fossil Filter	Effluent	99	7.3	34	13	16	7.5	9.5	82	4	<0.50	45	0.39	1.01	0.077	—	240	<50	260
April 12, 1999	Las Flores Maintenance Station	073217	Drain Inlet Insert - StreamGuard	Effluent	84	6.8	96	37	24	17	7.8	71	7.7	<0.50	18	0.94	1.49	0.28	—	260	<50	160
April 11, 1999	Las Flores Maintenance Station	073217	Drain Inlet Insert - Fossil Filter	Effluent	96	7.0	38	13	37	8.6	3.6	66	4.7	<0.50	34	0.27	0.71	0.079	—	270	<50	240
April 12, 1999	Rosemead Maintenance Station	073218	Drain Inlet Insert - StreamGuard	Effluent	99	7.5	57	18	26	13	12	145	9.1	0.98	100	0.62	1.45	0.105	—	230	<50	190
April 12, 1999	Rosemead Maintenance Station	073218	Drain Inlet Insert - Fossil Filter	Effluent	94	7.4	58	21	14	14	16	195	8.9	3.9	135	0.58	0.99	0.122	—	160	<50	110

(1) Analysis requested for samples from drain inlet inserts beginning on 3/25/99 by Caltrans but not required as part of OMM Plan. These analyses will be required in a revised OMM plan before the next wet season.

NR - Not Reported. Analysis was performed to comply with holding time requirements. However, paired samples were not successfully collected.
"—" - Not Analyzed

PRELIMINARY DATA
Submitted 5/25/99

BMP Retrofit Pilot Study, Solid Matrix Lab Data - District 7 (Law Crandall Sites)

Sample Date	BMP Location	Site ID	BMP Type	Total (mg/kg) Cu	Pb	Zn	TRPH (mg/kg)	Mass (grams)	Grain Size Distribution (% Passing) No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
Solids Matrix (Filter/Adsorbent Material/Sediment)				—	—	—	—	—	—	—	—	—	—	—	—
February 2, 1999	Unused - StreamGuard Fabric	—	Drain Inlet Insert - StreamGuard	0.22	<0.10	3.8	684	943.9	—	—	—	—	—	—	—
February 2, 1999	Unused - StreamGuard Absorbent	—	Drain Inlet Insert - StreamGuard	0.24	<0.10	0.6	1970	443.15	—	—	—	—	—	—	—
February 2, 1999	Unused - Fossil Filter Adsorbent	—	Drain Inlet Insert - Fossil Filter	0.2	1.2	1.2	26.6	380.84	—	—	—	—	—	—	—
January 29, 1999	Used - StreamGuard Fabric	073216	Drain Inlet Insert - StreamGuard	17.7	46.4	509	1130	1331	—	—	—	—	—	—	—
January 29, 1999	Used - StreamGuard Absorbent	073216	Drain Inlet Insert - StreamGuard	2.0	2.3	20.1	2620	465.1	—	—	—	—	—	—	—
January 29, 1999	Used - StreamGuard Sediment	073216	Drain Inlet Insert - StreamGuard	31.9	41.8	377	58000	100	—	—	—	—	—	—	—
January 29, 1999	Used - Fossil Filter Adsorbent	073216	Drain Inlet Insert - Fossil Filter	10.5	15.9	135	1910	300.65	—	—	—	—	—	—	—
January 29, 1999	Used - Fossil Filter Sediment	073216	Drain Inlet Insert - Fossil Filter	22.4	51.5	384	1610	120	—	—	—	—	—	—	—
April 8, 1999	Used - StreamGuard Fabric	073216	Drain Inlet Insert - StreamGuard	24.7	61.6	522	3670	1122	—	—	—	—	—	—	—
April 8, 1999	Used - StreamGuard Absorbent	073216	Drain Inlet Insert - StreamGuard	1.7	2.7	13.6	17900	493	—	—	—	—	—	—	—
April 8, 1999	Used - StreamGuard Sediment	073216	Drain Inlet Insert - StreamGuard	36.6	60.2	422	12500	177	—	—	—	—	—	—	—
April 8, 1999	Used - Fossil Filter Adsorbent	073216	Drain Inlet Insert - Fossil Filter	5.5	11.9	43.5	11100	3964	—	—	—	—	—	—	—
April 8, 1999	Used - Fossil Filter Sediment	073216	Drain Inlet Insert - Fossil Filter	38.4	110	321	12200	472	—	—	—	—	—	—	—
April 12, 1999	Used - StreamGuard Fabric	073216	Drain Inlet Insert - StreamGuard	9.9	23.5	162	2570	1420	—	—	—	—	—	—	—
April 12, 1999	Used - StreamGuard Absorbent	073216	Drain Inlet Insert - StreamGuard	0.3	0.25	2.8	2580	459	—	—	—	—	—	—	—
April 12, 1999	Used - Fossil Filter Adsorbent	073216	Drain Inlet Insert - Fossil Filter	8.6	17.3	80.5	3300	[illegible]	—	—	—	—	—	—	—
April 12, 1999	Used - Fossil Filter Sediment	073216	Drain Inlet Insert - Fossil Filter	20.9	36.3	177	[illegible]	191	—	—	—	—	—	—	—
Solids Matrix (Soil)															
January 28, 1999	I-605/91 Baseline Soil: 0.3-0.5 meter depth	073101	Infiltration Basin	19.5	5.1	45.9	<10.0	—	100	100	[illegible]	[illegible]	92	73	50
January 28, 1999	I-605/91 Baseline Soil: 0.6-0.8 meter depth	073101	Infiltration Basin	15.5	3.8	30.9	<10.0	—	100	[illegible]	[illegible]	[illegible]	84	58	31

NR - Not Reported. Analysis was performed to comply with holding time requirements. However, paired samples were not successfully collected.
"—" - Not Analyzed

BROWN AND CALDWELL MONITORING SITES (DISTRICT 7)

	Site ID: 074101			Site ID: 074102			Site ID: 074202			Site ID: 74203		
	I-5/605 Intersection monitoring station			I-605/SR-91 Intersection monitoring station			Eastern Regional MS, monitoring station			Foothilll MS, monitoring station		
Date of Storm Event	Sampled	Observations	Total Precipitation	Sampled	Observations	Total Precipitation	Sampled	Observations	Total Precipitation	Sampled	Observations	Total Precipitation
20-Mar-99	(1)	●	<0.16	(1)	●	<0.16	(1)	●	<0.16	(1)	●	0.16
25-Mar-99	(2)	●	0.40	●	●	0.48	(3)	●	0.14	(3)	●	0.25
6-Apr-99	●	●	0.78	●	●	0.76	●	●	0.88	●	●	1.46
11-Apr-99	●	●	1.05	●	●	1.62	(4)	●	0.90	●	●	0.85
Total Events Sampled	2			3			1			2		

(1) Insufficient runoff to collect paired composite samples.

(2) [redacted]

(3) [redacted]

(4) [redacted]

	Site ID: 112203			Site ID: 112203			Site ID: 112204			Site ID: 112204			Site ID: 112205			Site ID: 112205			Site ID: 112207			Site ID: 112207		
	La Costa P&R, KLI monitoring station (influent of Type I Sand Filter)			La Costa P&R, KLI monitoring station (effluent of Type I Sand Filter)			I-5 / SR-78 P&R, KLI monitoring station (influent of Type I Sand Filter)			I-5 / SR-78 P&R, KLI monitoring station (effluent of Type I Sand Filter)			SR-78 / Melrose, KLI monitoring station (influent of Biofiltration Swale)			SR-78 / Melrose, KLI monitoring station (effluent of Biofiltration Swale)			Carlsbad MS, KLI monitoring station (influent of Biofiltration Strip)			Carlsbad MS, KLI monitoring station (effluent of Biofiltration Strip)		
Date of Storm Event	Sampled	Observations	Total Precipitation	Sampled	Observations	Total Precipitation	Sampled	Observations	Total Precipitation	Sampled	Observations	Total Precipitation	Sampled	Observations	Total Precipitation	Sampled	Observations	Total Precipitation	Sampled	Observations	Total Precipitation	Sampled	Observations	Total Precipitation
25/26-Jan-99	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
1/30/1999 (a)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
5-Feb-99	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
3/5/1999 (b)																								
10-Mar-99	(3)	•	0.14	(3)	•	0.14	(3)	•	0.00	(3)	•	0.00	(3)	•	0.20	(3)	•	0.20	(3)	•	0.14	(3)	•	0.14
15-Mar-99	(3)	•	0.08	(3)	•	0.08	(3)	•	0.11	(3)	•	0.11	(3)	•	0.11	(3)	•	0.11	(3)	•	0.08	(3)	•	0.08
19/20-Mar-99 (c)																								
25/26-Mar-99	•	•	0.54	•	•	0.54	•	•	0.88	•	•	0.88	(3)	•	0.38	(3)	•	0.38	(3)	•	0.40	(3)	•	0.40
6/7-Apr-99	•	•	0.12	•	•	0.12	(5)	•	0.13	(5)	•	0.13	(3)	•	0.16	(3)	•	0.16	(3)	•	0.11	(3)	•	0.11
11/12-Apr-99	•	•	0.81	•	•	0.81	•	•	0.82	•	•	0.82	(3)	•	0.78	(3)	•	0.78	(3)	•	0.64	(3)	•	0.64
Total Events Sampled	3			3			2			2			0			0			0			0		

(a) KLI mobilized for a predicted storm event--it did not occur.
(b) [redacted]
(c) KLI [redacted]

(1) [redacted]
(2) [redacted]
(3) [redacted] However, [redacted]
(4) [redacted]
(5) Insufficient rainfall fall for enough samples to be taken at I-5/SR-78 Park and Ride Sand Filter for the April 6-7, 1999 Storm Event.
(6) Equipment problems which KLI is currently trying to solve led to I-15/SR-78 Extended Detention Basin not being sampled for the April 11-12, 1999 Storm Event.

APPENDIX E:

REPORT OUTLINE OF SUMMARY REPORTS

RETROFIT PILOT PROGRAM
CALTRANS DISTRICT 11

First Year 1998-1999 Report

BEST MANAGEMENT PRACTICES OPERATIONS, MONITORING, AND MAINTENANCE

APPENDIX F:

LA COSTA INFILTRATION BASIN GROUNDWATER LEVEL LOG

TABLE 1
WATER SURFACE ELEVATION SUMMARY SHEET

Date	Time	Reading		Groundwater Elev (FT)*	Delta (FT)	By	Comment
		Headwall (FT)	Monitoring Well (FT)				
12/12/97	---	---	BORING WW-1	2.22	4.34	GDC	Existing surface elevation: 10.22 ft (3.117m)
12/13/97	---	---	BORING WW-2	1.69	4.87	GDC	Existing surface elevation: 10.69 ft (3.258m)
12/23/97	---	---		No groundwater encountered.		GDC	**SD-7** Initial investigation monitoring well installed. (Bottom at 5 ft bgs.)
2/10/98	---	---	3.00	7.92	-1.36	GDC	Reading after a series of rain storms. Adjacent ground saturated and surface ponding observed.
4/21/98	---	---	5.85	7.34	-0.78	GDC	**SDMW-1** Permanent monitoring well installed. (Bottom at 20 ft bgs.)
6/30/98	10:00am	---	6.90	6.29	0.27	KLI	
7/31/98	4:15pm	---	6.95	6.24	0.32	KLI	
8/31/98	11:57am	---	7.17	6.02	0.54	KLI	
9/28/98	---	---	---	4.38	---	RBF	Exploratory hole excavated by contractor. Ground water elevation 0.54ft below original design invert, 4.92ft (1.5m)
11/2/98	4:04pm	---	7.60	5.59	0.97	KLI	
11/11/98	4:55pm	---	7.60	5.59	0.97	KLI	
12/2/98	---	---	7.61	5.58	0.98	KLI	
12/17/98	---	---	---	0	---	CT RE	Exploratory holes excavated 10.2 feet below invert elevation. No groundwater observed.
1/20/99	7:05am	---	7.14	6.05	0.51	GDC	
2/24/99	10:15am	2.08	---	---	---	GC	No signs of mosquitoes. Surface has 2"-3" dia algae.
3/2/99	2:00pm	1.88	---	---	---	AW	No vector issues.
3/9/99	11:00am	1.73	---	---	---	GC	No vector issues - no algae present from 2/24/99.
3/12/99	1:00pm	1.86	9.00	4.19	2.37	AW	No vector issues, < 0.1in rain on 3/11/99, no algae.
3/16/99	4:55pm	1.98	6.90	6.29	0.27	AW	No vector issues, < 0.2in rain on 3/15/99, 2mm dia algae scattered on water surface. Dried high-algae-line observed on headwall at 2.84ft mark.
3/23/99	10:00am	1.76	7.08	6.11	0.45	AW	No vector issues, no algae.
3/26/99	10:20am	2.48	9.00	4.19	2.37	AW	No vector issues, < 0.5in rain on 3/25/99, no algae.
3/30/99	9:05am	2.28	8.85	4.34	2.22	AW	No vector issues, 6-sf algae at NW corner. Vector Control District treated basin with Altosid briquettes and stocked basin with mosquito fish.
4/2/99	8:15am	2.89	8.35	4.84	1.72	AW	No vector issues, <0.5in rain on 4/1/99, no algae.
4/6/99	2:00pm	2.69	7.00	6.19	0.37	AW	No vector issues, no algae.

BMP RETROFIT PILOT PROGRAM
PS&E LOCATION 3
I-5/LA COSTA AVE INFILTRATION BASIN

TABLE 1
WATER SURFACE ELEVATION SUMMARY SHEET

Date	Time	Reading		Groundwater Elev (FT)*	Delta (FT)	By	Comment
		Headwall (FT)	Monitoring Well (FT)				
4/9/99	10:00am	2.67	7.00	6.19	0.37	AW	No vector issues, 1mm dia algae, 8sf at NW corner.
4/13/99	10:00am	2.89	6.91	6.28	0.28	AW	No vector issues, <0.8in rain on 4/11/99, <1mm dia algae approx 8sf.
4/20/99	9:50am	2.52	9.30	3.89	2.67	AW	No vector issues, algal mats at NW corner.
4/27/99	2:25pm	2.50	7.10	6.09	0.47	AW	No vector issues, 6-1-2ft dia algal mats.
5/5/99	1:10pm	2.06	7.00	6.19	0.37	AW	No vector issues, few scattered 1-5mm dia algae.
5/18/99	5:55pm	1.66	7.15	6.04	0.52	AW	Minor vector issues, refer to OMM Vector Issues, collection of small floating algae mats varying 4-8" wide and approx. 10ft long.
5/25/99	5:40pm	1.50	7.10	6.09	0.47	AW	No vector issues, 6-12" wide algal mat at perimeter of the basin.

*

Temporary Well: Well Cover elevation 10.99 ft (3.35m). Well rim elevation 10.92 ft.

WSE at monitoring well = Well cover elevation (FT) - Monitoring Well Reading (FT)

*

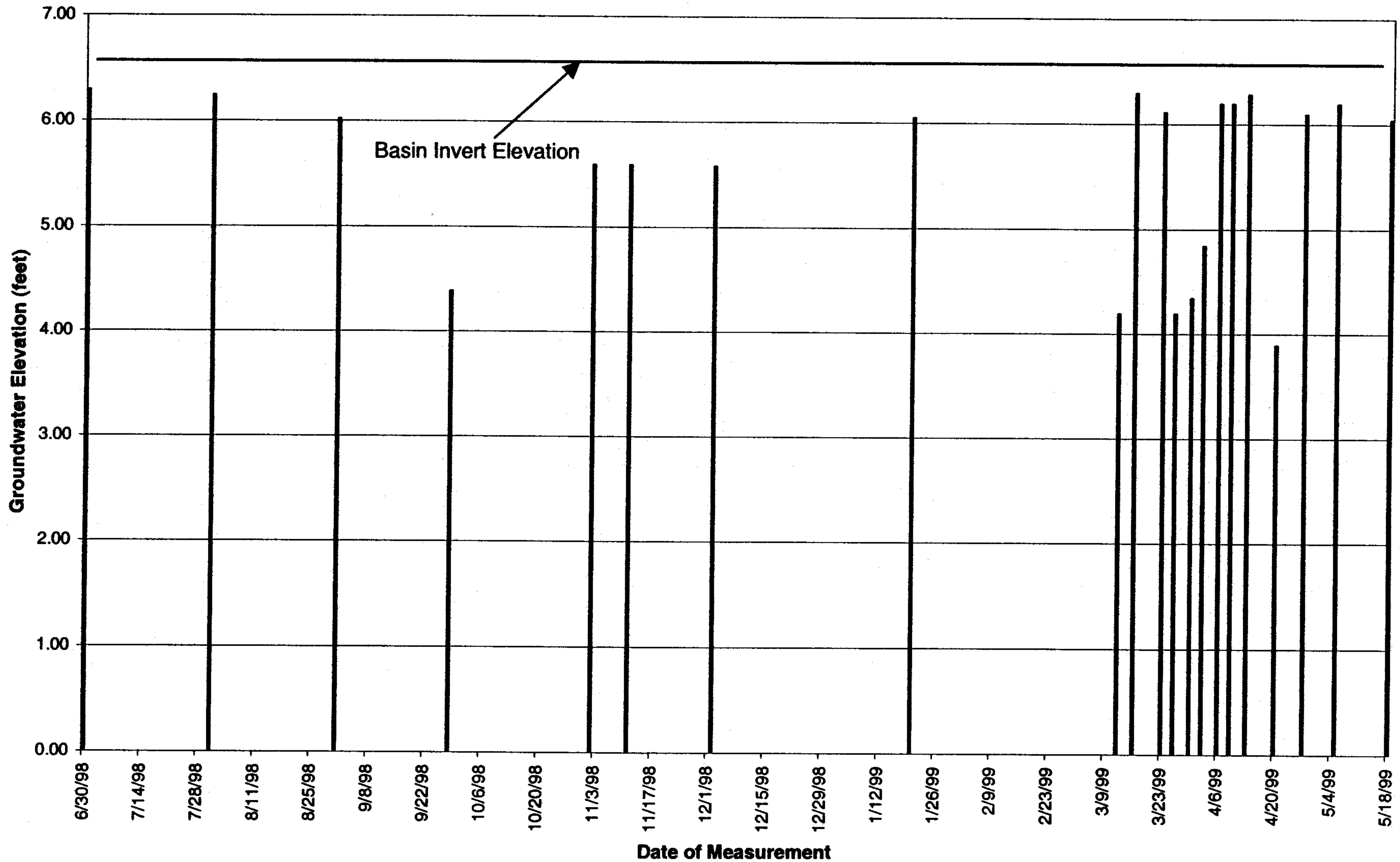
Permanent Well: Monitoring well notch at elevation 13.186 ft (4.02m)

WSE at monitoring well = Notch elevation (FT) - Monitoring Well Reading (FT)
Monitoring Well reading = Distance to groundwater surface

Delta = Basin Invert - Groundwater elevation
Basin Invert = 6.56 FT (2.0m)

AW- RBF
GC- RBF
GDC-Group Delta Consultants (Formerly LKR- The LKR Group, Consulting Geotechnical Engineers)
KLI- Kinnetic Laboratories, Inc.
CT RE- Caltrans Resident Engineer

Groundwater Level Monitoring at I-5/La Costa Infiltration Basin Site



APPENDIX G:

MAINTENANCE INDICATOR DOCUMENT

CALTRANS BMP RETROFIT PILOT PROGRAM
BMP MAINTENANCE INDICATORS

The following specific thresholds are for specified and implied criteria which "trigger" maintenance activities for specific BMPs. The maintenance activity shown is for those times when the field measurement exceeds the maintenance indicator. These thresholds do not preclude taking other actions needed to mitigate the given thresholds or taking actions needed to mitigate unanticipated problems. These indicators are not only for the BMP pilot program, but they are also considered representative of the long-term maintenance requirements for the BMPs.

This document covers routine maintenance. There may be occasions where emergencies arise, such as accidents, toxic spills, or other incidents, where critical response is needed. On those occurrences, Caltrans crews will respond to the emergency, on a priority basis and, if necessary, the BMP will be taken out of service until the BMP can be restored. The goal for such critical situations is to have the BMP back into service within 30 days.

The time period noted, for completion of any maintenance activity, is a goal that will depend on weather, access to the BMP, personnel and equipment availability.

BIOFILTER – STRIPS and SWALES
Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Uniform sheet flow over length of strip and across swale invert	Evidence of significant channeling or ponding	Visual inspection of erosion or major portions of flow discharge across strip/swale	Monthly, during target storms in the wet season	Correct channelized or ~~low~~ ponded areas using additional fill and vegetation and/or by removing accumulated sediment. Target completion time is within 10 days.	None
Height of vegetation	Average plant height exceeds 10 inches	Visual inspection of vegetation throughout strip/swale	In October , and January and monthly during dry season	Cut plants to a average height of 6 inches and remove trimmings. Target completion within 10 days.	Palomar Airport Road Site: maximum average height is 13 inches; trim to 9 inches
Assess ~~A~~adequate vegetative cover	Less than 90 percent coverage in strip	Visual inspection of strip/swale	Assess quantity needed in May each	Order appropriate amount of sod. Re-	None

BIOFILTER – STRIPS and SWALES

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
	invert/swale or less than 70 percent on swale side slope		year	sod barren spots during November. Irrigate until soil moisture is sustained by rain or sod becomes established.	
Residence time is less that design criteria	Residence time is less than design criteria	Measure mean residence times in swale using protocol in OMM plan. Calculate residence time for design storm.	Once per year during target storm	Assess the cause of the problem. As soon as weather and moisture conditions allow, take corrective action. If sediment is the cause, in September, remove and dispose of accumulated sediment. Regrade to restore flow gradient. Resod by November 1	Swales only Cerritos MS – 4 min 605/91 – 9 min 5/605 – 7 min 605/Carson – 9 min Palomar – 14 min Melrose – 15 min
Inspect for debris accumulation	Debris or trash present	Visual observation	Monthly	Remove trash and debris. Target completion period within 10 days.	None
Inspect for accumulated sediment	Sediment at or near plant height, channeling of flow, inhibited flow due to change in slope	Visual observation	Monthly during wet season	~~If sediment is excessive,~~ remove sediment. If flow is channeled, ~~determ ine~~determine cause and take corrective	None

BIOFILTER – STRIPS and SWALES

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
				action.-If sediment becomes deep enough to change the flow gradient, remove sediment, conduct sediment charaterization according to OMM Plan Vol II, dispose of sediment, and replant. Regrade to design specification and replant swale/strip with sod. If regrading is necessary, the process should start near May 1. Resod strip/swale in Nov. Target completion period within 10 days.	
Inspection for sediment management and characterization of sediment for removal	Any parameter concentration (See Vol II) exceeds 50% of Title 22 TTLC. Or, if the parameter concentration falls between 10X STLC and TTLC, is less than 50% TTLC, and the WET results exceed	Sample according to OMM plan Vol II and send samples to lab	May 1 each year	If sediment characterization exceeds maintenance indicator, remove and dispose of sediment. Regrade and revegetate if vegetation coverage drops below 90 percent in the invert or	None

BIOFILTER – STRIPS and SWALES

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
	50 % of the STLC value.			70 percent on the slopes. Revegetate slopes with seed and inverts with sod on Nov. 1	
Inspect for possible ~~habitat associated with~~ endangered species, ~~and~~ threatened species and species of special concern within the BMP maintenance perimeter ~~habitat~~	Evidence of ponding, emergence of wetland or woody vegetation, shrubs, dwarf plantain, or burrowing animal damage. Presence of logs, woodpiles rocks, or large debris.	Visual observation	Weekly, during the wet season	• Remove woody vegetation, shrubs, dwarf plantain, pickleweed and emergent wetland vegetation, and large debris within strip/swale within 10 days. • Correct ponded areas using sand fill within 3 days. • Cover all burrows with wire mesh and soil within 3 days. If burrows are found between Mar 1 and Aug 30, a biologist needs to confirm that no birds are nesting in the burrow before sealing the hole.	Vulnerable sites are: SR-78/Melrose I-5/Palomar Airport Rd

BIOFILTER – STRIPS and SWALES

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
				• At vulnerable sites, remove debris, woodpiles etc. within 10 days.	
General Maintenance Inspection	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, emergence of trees or woody vegetation, fence damage, etc.	Visual observation	Monthly	Take action as needed to correct problems. Target completion period within 30 days.	None

DRAIN INLET INSERTS – STREAM GUARD[3]

Preventive Maintenance and Routine Inspections

For drain inlet inserts, replacement of insert is specified as part to the testing portion of the BMP pilot program and deference is to replacement interval will be given to the testing portion of the program.

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Sediment removal	Sediment more than 6-inches	Visual inspection of sediment collected within insert	• Before each target storm event • Weekly during extended wet periods • Monthly during periods of dry weather	Replace insert. Target completion period within 10 days.	None
Inspect for debris/trash	Sufficient debris/trash that could interfere with proper functioning of insert	Visual observation	• Before and once during each target storm event • Weekly during extended wet periods	Remove and dispose of debris/trash. Target completion period within 1 day.	None
Oil and grease removal	Evidence of oily sheen in insert or downstream monitoring vault	Visual observation	During each target storm event and monthly during the dry season	Within 10 working days, replace oil absorbent polymer	None
Inspection for structural integrity	Improper installation, rips, tears, or other loss of structural integrity	Visual observation	Monthly	Replace insert or immediately consult with design engineer to develop a course of action, effect repairs within 10 working days	None

DRAIN INLET INSERTS – FOSSIL FILTER[3]

Preventive Maintenance and Routine Inspections

For drain inlet inserts, replacement of insert is specified as part to the testing portion of the BMP pilot program and deference is to replacement interval will be given to the testing portion of the program

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Inspect for debris/trash	Sufficient debris/trash that could interfere with proper functioning of insert	Visual observation	• Before and once during each target storm event • Weekly during extended wet periods • Monthly during the dry season	Remove and dispose of debris/trash. Target completion period within 1 day.	None
Oil and grease removal	Absorbent granules dark gray, or darker, or unit clogged with sediment.	Visual observation	• At the end of each target storm event • Weekly during extended wet periods • Monthly during the dry season	Replace Fosil Filter™ trough within 10 working days.	None
Inspection for structural integrity	Broken or otherwise damaged insert	Visual observation	Monthly	Replace insert or immediately consult with design engineer to develop a course of action, effect repairs within 10 working days	None

EXTENDED DETENTION BASINS

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Drain time is 72 hours for design volume	Less than 48 hours or more than 72 hours for full basin	Determine drain time based on effluent flow meter activity or visual observation	Immediately after each target storm	• If time too long, open gate to discharge remaining volume, within 1 day. Per direction from design engineer, modify holes on standpipe after basin drains, within 30 days • Remove and dispose of debris/trash from outlet/outlet screen, within 10 days.	• Does not apply to District 7 Extended detention Basins • Clean rip-rap and standpipes in District 7
Basin side slope planted for erosion protection and planted invert	Average plant height greater than 18-inches	Visual observation and random measurements through out the side slope area	Monthly	Cut vegetation to an average height of 12-inches and remove trimmings. May cut to 8 inches after July 1. Target completion period within 30 days Do not cut more than four times per year,	None
Inspect for adequate vegetative cover	Less than 70 percent coverage on invert and side slopes	Visual observation	October each year	Hydroseed barren spots by Nov 1	

EXTENDED DETENTION BASINS

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Inspect for possible vector harborage	Standing water for more than 72 hours	Visual observation	Monthly and 72 hours after target storm event	Immediately notify VCD for vector abatement assessment	None
Inspection for trash and debris at inlet and outlet structures	Debris/trash present	Visual observation	Monthly and before every target storm	Remove and dispose of trash and debris Target completion period within 10 days.	None
Inspection for sediment management and characterization of sediment for removal	• Sediment depth averages 18-inches or 10 percent of basin volume which ever is less • Any parameter concentration (See Table 5.2, Vol II) exceeds 50% of Title 22 TTLC. Or, if the parameter concentration falls between 10X STLC and TTLC, is less than 50% TTLC, and the WET results exceed 50 % of the STLC value.	• Measure depth at apparent maximum and minimum accumulation of sediment. Calculate average depth • Sample according to OMM plan and send samples to lab	June 1 each year	Remove and dispose of sediment. Regrade and revegetate if vegetation coverage drops below 70 percent. Revegetate with seed as required by threshold on Nov. 1	None

EXTENDED DETENTION BASINS

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Inspect for possible endangered species, threatened species and species of special concern.-within the BMP maintenance perimeter. ~~habitat associated with species, and species and of special concern habitat~~	Evidence of ponding, emergence of wetland or woody vegetation, shrubs, dwarf plantain, or burrowing animal damage. Presence of logs, woodpiles, rocks, or large debris.	Visual observation	Weekly, during the wet season	• Remove woody vegetation, shrubs, dwarf plantain, pickleweed and emergent wetland vegetation in the basin within 10 days. • Remove debris, woodpiles etc. within 10 days. • Correct ponded areas using sand fill • Cover all burrows with wire mesh and soil within 3 days. • For vulnerable sites, on Mar 1, deploy stakes with mylar strips and place scarecrow device around BMP. • If burrows are found between Mar 1 and Aug 30, a biologist	Vulnerable sites are: I-5/SR56 I-5/Manchester I-15/SR-78

EXTENDED DETENTION BASINS

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
				needs to confirm that no birds are nesting in the burrow before sealing the hole.	
General Maintenance Inspection	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, emergence of trees or woody vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Monthly	Within 10 working days, take corrective action. Consult engineers is immediate solution is not evident.	None

INFILTRATION BASINS

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
72 hour infiltration of design volume	Evidence of ponding water after 72 hours	Evaluation of water level within basin using data logging bubbler or visual observation of basin for evidence of ponding water	72 hours after target storm event	Remove sediment, scarify invert and revegetate before November 1. If problem persists, immediately notify engineer. Undertake investigation for course of action to achieve acceptable infiltration rate or other acceptable solution. If unable to achieve acceptable infiltration rate or implement alternative solution then move to decommission	None
Vegetation of basin invert and side slopes	Plant height exceeds 12 inches	Visual observation and random measurements through out the side slope and invert area	Monthly	Cut vegetation to a height of 6 inches and remove cuttings. Target completion period within 30 days.	None
Inspect for possible vector harborage	Standing water for more than 72 hours	Visual observation	Monthly and 72 hours after target storm event	Immediately notify VCD for vector abatement assessment	None
Inspection for trash and debris at inlet structures	Debris/trash present	Visual observation	Monthly	Remove and dispose of debris/trash. Target completion period within 10 days.	None

INFILTRATION BASINS

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Inspection for sediment management	Sediment accumulation greater than 18-inches or 10 percent of basin volume which ever is less	Measure depth at apparent maximum and minimum accumulation of sediment. Calculate average depth	June 1 each year	Remove, characterize and dispose of sediment. Regrade and revegetate if vegetation coverage drops below 70 percent. Revegetate with seed as required by threshold on Nov. 1	None
Inspection and characterization for sediment removal	Any parameter concentration (See Table 5.2, Vol II) exceeds 50% of Title 22 TTLC. Or, if the parameter concentration falls between 10X STLC and TTLC, is less than 50% TTLC, and the WET results exceed 50 % of the STLC value.	Sample according to OMM plan and send samples to lab	~~June 1~~May 1 each year	Remove and dispose of sediment regrade basin floor to ensure proper drainage. Revegetate on November 1 if coverage falls below 70%.	None
Vegetation coverage inspection	Coverage falls below 70 percent	Visual observation	During month of September	Plant during month of November	None
Inspect for possible endangered species, threatened species and species of special concern within the BMP maintenance	Evidence of ponding, emergence of wetland or woody vegetation, shrubs, dwarf plantain, or burrowing animal damage. Presence of	Visual observation	Weekly, during the wet season	• Remove woody vegetation, shrubs, dwarf plantain, pickleweed and emergent wetland vegetation in the basin	None

INFILTRATION BASINS

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
perimeter.	logs, woodpiles, rocks, or large debris.			within 10 days. • Remove debris, woodpiles etc. within 10 days. • Correct ponded areas using sand fill and cover all burrows with wire mesh and soil within 3 days. If burrows are found between Mar 1 and Aug 30, a biologist needs to confirm that no birds are nesting in the burrow before sealing the hole.	
General Maintenance Inspection	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, emergence of trees or woody vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Monthly	Within 30 working days, take corrective action. Consult engineer if immediate solution is not evident.	None

INFILTRATION TRENCHES

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Design infiltration rate	Infiltration rate falls below 90 percent of design rate	Calculate infiltration rate with pressure transducer or measure in observation well	After each target storm	Immediately notify engineer. Undertake investigation for course of action to achieve acceptable infiltration rate. If unable to achieve acceptable infiltration then BMP operations cease.	Carlsbad MS – 1.2 in/hr Altadena MS – 1.5 in/hr
Inspect for possible vector harborage	Standing surface water for more than 72 hours	Visual observation	Monthly and 72 hours after target storm event	Immediately notify VCD for vector abatement assessment	None
Inspection for trash and debris at inlet and outlet structures	Trash/debris present	Visual observation	Monthly	Remove and dispose of trash and debris. Target completion period within 10 days.	None
Inspect for sediment accumulation	Visible sediment	Visual inspection of the stone aggregate, no sediment should be visible at the top of the trench.	Monthly during the dry season After every storm greater than 0.5-inches	Remove top layer of trench, silt, filter fabric and stone, wash stone and reinstall fabric and stone into trench	None

INFILTRATION TRENCHES

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
General Maintenance Inspection	Inlet structures, outlet structures, filter fabric or other features damaged, emergence of trees or woody vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Monthly	Within 30 working days, take corrective action. Consult engineer if immediate solution is not evident.	None

MEDIA FILTERS – ~~COMPOST~~PERLITE/ZEOLITEf

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Design flow rate through canisters: 15 gpm per canister	Less than 13 gpm flow rate per canister, measured collectively on a per vault basis	Evaluate peak and average flow rates drain time from inlet and outlet flow data loggers or staff gage within vaults	During one storm per month during wet season	Within 10 working days or as weather conditions permit, back flush canisters and remove sediment in the vault. If back flushing does not restore flow through rate, replace canisters.	None
Inspect for sediment accumulation in pre-treatment sedimentation chamber	Maximum 12-inches, or Any parameter concentration (See Vol II) exceeds 50% of Title 22 TTLC. Or, if the parameter concentration falls between 10X STLC and TTLC, is less than 50% TTLC, and the WET results exceed 50 % of the STLC value.	Measure with appropriate device Characterize sediment by sampling according to OMM plan Vol II	Measure sediment depth ~~M~~monthly during period of extended wet weather. Characterize sediment ~~otherwise~~ annually on May 1	Remove sediment within 10 days during wet season, characterize sediment and dispose of the sediment within ~~otherwise~~ within 30 days If sediment characterization exceeds maintenance indicator, remove and dispose of sediment.	

MEDIA FILTERS – ~~COMPOST~~PERLITE/ZEOLITEf

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Inspect for minor maintenance	Per manufacture's guidelines	None	Monthly	Flush underdrains and other maintenance per manufacturer's guidelines.	None.
Manufacturer's recommended major maintenance	Per manufacture's guidelines	Per manufacture's guidelines	Annually, May 1	Replace canisters, remove sediment and other maintenance per manufacturer's guidelines	None
Inspection for trash and debris at inlet and outlet structures and within vaults	Trash/debris present	Visual observation	Weekly during the wet season and monthly during the dry season	Remove and dispose of trash and debris. Target completion period within 1 day during wet season and 10 days during dry season.	None
Inspect for vector harborage	Standing water for more than 72 hours	Visual Observation	Monthly and 72 hours after target storm event	Immediately notify VCD for vector abatement assessment. Renew vector control briquettes every 3 months.	None
General Maintenance Inspection	Inlet structures, outlet structures, vault, piping, or other features damaged and for graffiti or vandalism	Visual observation	Monthly	Within 30 working days, take corrective action. Consult engineer if immediate solution is not evident.	None

MEDIA FILTERS – SAND

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Design filter loading rate of 0.0545 gpm/sf (10.5 ft/d), or Drain time of 48 hours	Loading rate drops below 9 ft/d or Drain time exceeds 48 hours	Use staff gage in vault to measure loading rate, or Evaluate peak and average loading rates from inlet and outlet flow data loggers or.	During one storm event per month if staff gage is used. After one storm event per month during wet season	Remove sediment, trash and debris., remove top 2 inches of media and dispose of sediment. Restore media depth to 18 inches when overall media depth drops to 12 inches. Target completion period within 10 days. If problem persists, consult with engineer.	None.
Inspect for sediment accumulation in sedimentation chamber~~Inspect for sediment accumulation in pre-treatment sedimentation chamber~~	Maximum 12-inches, or Any parameter concentration (See Vol II) exceeds 50% of Title 22 TTLC. Or, if the parameter concentration falls between 10X STLC and TTLC, is less than 50% TTLC, and the	Measure with appropriate device Characterize sediment by sampling according to OMM plan Vol II and send samples to lab~~Measure with appropriate device~~	Measure sediment depth monthly during period of extended wet weather. Characterize sediment annually on May 1~~Monthly during period of extended wet weather otherwise annually on May 1~~	Remove sediment within 10 days during wet season, characterize sediment and dispose of the sediment within within 30 days If sediment characterization exceeds maintenance indicator, remove and dispose of sediment. ~~Remove sediment within 10 days during wet season, otherwise within 30 days~~	

MEDIA FILTERS – SAND

Preventive Maintenance and Routine Inspections

	WET results exceed 50 % of the STLC value. ~~Maximum 12 inches~~				
Inspect for vector harborage	Standing water for more than 72 hours	Visual observation	Monthly and 72 hours after target storm event	Immediately notify VCD for vector abatement assessment. Renew vector control briquettes every 3 months or as recommended by the VCD~~.~~	None
Inspection for trash / debris at inlet and outlet structures and on media surface	Trash and debris present	Visual observation	Weekly during the wet season and monthly during the dry season	Remove and dispose of trash and debris. Target completion period within 1 day during wet season and 10 days during dry season.	None
Inspect pumps for proper functioning	Pump does not operate	Energize pump to see if water is discharged	September or after one month of inactivity during the wet season	Make assessment to determine if problem is electrical or mechanical. Take appropriate action. Replace pump if needed. Target completion time is 10 days (keep one pump in storage as back-up)	District 7 filters only
Inspect pumps for serviceability and	Per manufacture's guidelines	Per manufacture's guidelines	Per manufacture's guidelines	Per manufacture's guidelines	District 7 filters only

MEDIA FILTERS – SAND

Preventive Maintenance and Routine Inspections

periodic maintenance					
Inspect for possible endangered species, threatened species and species of special concern within the BMP maintenance perimeter.~~ habitat associated withspecies, ~~ ~~and habitat~~ ~~and species of special concern~~	Presence of bare ground, sparse ground cover, woodpiles, rocks, logs, rocks, evidence of burrowing animal damage or evidence of ponding, emergence of wetland or woody vegetation, shrubs, dwarf plantain,	Visual observation	Weekly, during the wet season	• On March 1 place nylon/plastic mesh with mylar strips over the filter sand area to prevent bird nesting. Remove the mesh and mylar in September each year. If nesting occurs in the BMP, immediately notify the engineer. • Remove debris, woodpiles etc. within 10 days. •Cover all burrows with wire mesh and soil within 3 days. On Mar 1, deploy stakes with mylar strips and place scarecrow device around BMP. If burrows are found between Mar 1 and Aug 30, a biologist needs to confirm that no birds are nesting in the burrows before sealing the hole.	Vulnerable sites: I-5/La Costa PR I-5/SR-78 PR

MEDIA FILTERS – SAND

Preventive Maintenance and Routine Inspections

				Remove floating debris and dead and floating vegetation mats within 10 days. • Remove woody vegetation, shrubs, dwarf plantain, pickleweed and emergent wetland vegetation outside the wetted pond area within 10 days.	
General Maintenance Inspection	Inlet structures, outlet structures, filter fabric or other features damaged, emergence of vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Monthly	Within 30 working days, take corrective action. Consult engineer if immediate solution is not evident.	None

MULTI-CHAMBER TREATMENT TRAINS

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Maximum filter drain time of 72 hrs for design and smaller storms	Drain time greater than 72 hours	Visual observation	After each target storm	If filter surface has sediment, remove and replace filter fabric blanket. Target completion period within 10 days. If problem persists, consult with engineer, the media may need to be replaced.	None
Inspection for trash/ debris at inlet and outlet structures and the MCTT	Trash/debris present	Visual observation	Weekly during the wet season and monthly during the dry season	Remove and dispose of trash and debris. Target completion period within 1 day during wet season, 10 days during dry season..	None
Inspection for sediment accumulation	Maximum of 6-inches in main settling chamber Maximum of 2-inches in grit chamber, or Any parameter concentration (See Vol II) exceeds 50% of Title 22 TTLC. Or, if	Measure with appropriate device Characterize sediment by sampling according to OMM plan Vol II and send samples to	Measure sediment depth monthly during period of extended wet weather. Characterize sediment annually on May 1~~Monthly during periods of extended~~	Remove sediment within 10 days during wet season, characterize sediment and dispose of the sediment within within 30 days If sediment characterization exceeds maintenance indicator, remove and	None

MULTI-CHAMBER TREATMENT TRAINS

Preventive Maintenance and Routine Inspections

	the parameter concentration falls between 10X STLC and TTLC, is less than 50% TTLC, and the WET results exceed 50 % of the STLC value.	lab	~~wet weather~~	dispose of sediment.~~Within 10 working days remove and dispose of sediment.~~	
Inspect for possible vector harborage	Standing water for more than 72 hours	Visual observation	Monthly and 72 hours after target storm event	Immediately notify VCD for vector abatement assessment. Renew vector control briquettes every 3 months.	None
Replace filter media every 3 years per designer's specification	Operation greater than 3 years	Not applicable	Every 3 years	Remove and replace filter media	None
Renew sorbent pillows in main settling chamber every year per designer's specification	Not applicable	Not applicable	Annually at the end of the wet season	Renew sorbent pillows	None
Inspect pumps for proper functioning	Pump does not operate	Energize pump to see if water is discharged	September or after one month of inactivity during the wet season	Make assessment to determine if problem is electrical or mechanical. Take appropriate action. Replace pump if needed. Target	None

MULTI-CHAMBER TREATMENT TRAINS

Preventive Maintenance and Routine Inspections

				completion time is 10 days (keep one pump in storage as back-up)	
Inspect pumps for serviceability and periodic maintenance	Per manufacture's guidelines	Per manufacture's guidelines	Per manufacture's guidelines	Per manufacture's guidelines	None
General Maintenance Inspection	Inlet structures, outlet structures, filter fabric, settling tubes or other features damaged, emergence of vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Monthly	Within 30 working days, take corrective action. Consult engineer if immediate solution is not evident.	None

OIL-WATER SEPARATOR

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Inspect for sediment accumulation in the pre-separator and separator chamber	Greater than 12-inches	Measure with appropriate device	Monthly	Within 10 working days remove the accumulated material with a suction hose from a vacuum vehicle or portable pump.	None
Inspect for oil accumulation in oil chamber	Oil depth is not more than 50 percent of chamber volume	Gauge the level of oil/water with a wooden gauge stick	Monthly	Within 10 working days remove and dispose of oil and grease.	None
Inspect coalescer for debris and gummy deposits	Debris or gummy deposits present	Visual observation	Two times per year – at the beginning and end of each wet season (Sep 1 and April 15)	Wash the coalescer with a high-pressure hot water.	None
Inspect water level in tank	Less than full	Visual observation	Monthly	Fill with water within 1 day	None
Inspect for general mechanical integrity	Per manufacture's guidelines	Per manufacture's guidelines	Monthly during the wet season and before the beginning of the wet season	Operate each mechanical component to ensure proper operation. Repair as needed	None

WET BASIN

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
24 hour draw down measured between the spillway rim and invert of the WQ basin inlet pipe	Drawdown greater than 25 hours or water is flowing over spillway.	Evaluate drain time from inlet and outlet flow data loggers or observe 25 hours after target storm. Observation of water flowing over spillway	After each target storm event	If >25-hours: Open gate to discharge water to permanent pool elevation, clear outlet of debris. Consult engineer if needed. If water is spilling over spillway open canal gate until water level is at permanent pool elevation.	None
Inspect for possible endangered species, threatened species and species of special concern within the BMP maintenance perimeter.~~habitat associated with species, and species and of special concern habitatthe~~	Evidence of emergence of woody vegetation, shrubs, dwarf plantain, or wetland vegetation, burrowing animal damage. Presence of logs, woodpiles, rocks, or large debris.	Visual observation	Weekly, during the wet season	• Remove woody vegetation, shrubs, dwarf plantain, pickleweed and emergent wetland vegetation outside the wetted pond area within 10 days. • Remove debris, woodpiles etc. within 10 days. •Cover all burrows with wire mesh and soil within 3 days. On Mar 1, deploy stakes	None

WET BASIN

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
				with mylar strips and place scarecrow device around BMP. If burrows are found between Mar 1 and Aug 30, a biologist needs to confirm that no birds are nesting in the burrows before sealing the hole. Remove floating debris and dead and floating vegetation mats within 10 days. •Maintain wetland vegetation only between August and February	
General Maintenance Inspection	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, graffiti or vandalism, fence damage, etc.	Visual observation	Monthly	Within 10 working days, take corrective action. Consult engineers is immediate solution is not evident.	None
Inspect ~~for wetland vegetation management~~zone of	•Wetland plant~~s~~ ~~cover~~density ~~less than 30 percent or more 75~~	Visual observation/estimate	Annually, approx. May 1	By Nov 1 each year: • Restore to "as constructed" plant	None

WET BASIN

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
periodic inundation vegetation	~~30 percent or more 75 percent of the basin's~~ in the zone of periodic inundation is maintained at the "as constructed" density, per the attached exhibit			constructed" plant density ~~? If less than 30 percent coverage replant vegetation on November 1 to restore to 30 percent coverage~~ • ~~If more than 75 percent coverage, thin plants to approximately 30 percent coverage~~	
Inspect open water vegetation	•Less than 30 percent of contiguous open water in the permanent pool, per the attached exhibit.	Visual observation/estimate	Annually, approx. May 1	• Remove all plant material in the permanent pool area	
Inspect for sediment accumulation in forebay and main pond	More than 2 inches in the forebay and 4 inches in the main pond, or	Measure with appropriate device	Monthly	Remove and dispose of sediment. Target completion period within 30 days. If vegetation coverage drops below 30 percent during maintenance operation, replant	La Costa site only

WET BASIN

Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
				vegetation on November 1 to restore to 30 percent coverage	
	Any parameter concentration (See Vol II) exceeds 50% of Title 22 TTLC. Or, if the parameter concentration falls between 10X STLC and TTLC, is less than 50% TTLC, and the WET results exceed 50 % of the STLC value.	Sample according to OMM plan Vol II and send samples to lab	May 1 each year	If sediment characterization exceeds maintenance indicator, remove and dispose of sediment. Regrade and revegetate. If vegetation coverage drops below below 30 percent during maintenance operation, replant vegetation on November 1 to restore to 30 percent coverage	

CONTINUOUS DEFLECTIVE SEPARATION (CDS) UNITS
Preventive Maintenance and Routine Inspections

DESIGN CRITERIA, ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE SPECIFIC REQUIREMENTS
Inspect for accumulation of trash and debris	Unit 85 percent full	Visual observation	Monthly during the wet season	Empty unit when the it is 85 percent full or annually in May, effect cleaning within 30 days	
Inspect for vector harborage	Standing water for more than 72 hours	Visual observation	Monthly and 72 hours after target storm event	Immediately notify VCD for vector abatement assessment.	None
Inspection for structural integrity	Holes in screen, large debris, or other damage to housing	Visual observation	Monthly during the wet season and annually in May	Immediately consult with engineer to develop a course of action, effect repairs within 10 working days	

Notes for all BMPs:
1. Design storm event is a storm that is a one year 24 hour recurrence frequency.
2. A target storm event is a storm with a predicted greater than 0.~~1~~25 inches of rainfall or 0.1 inches for drain inlet inserts. Storm events should be separated by at least 72 hours of dry weather from the previous storm event. ~~and having greater than 0.1 inch of accumulation.~~
3. The Drain Inlet Inserts will be changed according to the schedule presented in the OMM Plan Volume II during the study period. After the study period, they will be serviced according to this document.

This Maintenance Indicator Document has been developed using site-specific information gathered by specialists trained in the identification of threatened and endangered species and their habitat. Information contained in this document includes guidance for inspection for possible threatened and endangered species harborage. Further, some of the maintenance recommendations are based on the requirements of specific plant species used in this Pilot Program. The recommendations provided in this document must be reassessed with respect to species and plant materials if the guidance contained herein is to be used for a separate project in another area.

APPENDIX H:

ASSESSMENT OF THE CONDITION OF THE SALTGRASS SOD

Saltgrass Design Review and Assessment

This discussion provides background information relative to the design, material acquisition and maintenance of the saltgrass *(Distichlis spicata)* biofilter planting component of the BMP Retrofit Pilot Program. In addition, recommendations are provided in the event that future saltgrass plantings are desired. The purpose of the recommendations is to prevent problems encountered to date by describing a planning process that incorporates the scheduling required to ensure a successful project.

Design

Criteria for the biofilter plantings were developed and planting recommendations were made based on those criteria. The plant species chosen were required to perform the following functions:

- Filter suspended solids from runoff from paved areas
- Withstand one-year storm events (flow)
- Adapt to climate conditions within Caltrans Districts 7 and 11
- Tolerate periods of both high and low moisture
- Be low-growing (to maintain structure under flow conditions)
- Require little maintenance (mowing, watering, fertilization)

A list of species (see Table 1) that met the criteria was prepared and included the following information: life form, height, origin, beneficial/detrimental characteristics and comments. A second list (see Table 2) provided recommendations for the planting rates and type of material (seed or container-grown plants) to be used.

In order to increase the likelihood of adequate plant cover in the shortest possible time, while fulfilling the criteria described above, it was recommended that a mixture of species be planted together. It is an accepted practice that this approach reduces the potential for damage from diseases and pests that could occur with a one-species, monoculture-type planting. In addition, fast growing annuals can be planted with slower germinating perennials to ensure adequate plant cover, both initially and for the long-term.

Full plant coverage in a minimum amount of time was needed since the projects are located in active flow areas, and irrigation is generally not available to promote germination and establishment of plant materials. Consequently, it was decided that a sod-like material was required for the biofilters. Since the annual species within the recommended species mix could not be grown as sod and could not be seeded over existing sod, the annual species were deleted from the list. The other recommended container-grown plant materials ("groove-tubes" of *Nasella* spp.) were also deleted from the list due to incompatibility with the sod-type requirement.

From the recommended list of species, saltgrass was considered the only species with suitable characteristic to be grown as sod and to perform the bio-filtering function. Benefits of saltgrass as a biofilter include that it is a perennial grass, grows 6-20 inches high, forms rhizomes/stolons, is stout, hardy, and adapts to harsh soil conditions (wet or dry) and silt build-up, forms a tough mat-like cover and recovers well from disturbance. A possible detrimental characteristic of saltgrass is that it is a warm season grass, and as such, it goes dormant and turns brown during the coldest winter months, and does not germinate during the winter.

Planting time for most annual (cool season) species of grasses in Southern California is mid- to late fall when cool temperatures, shortened day length and moisture are often optimal for germination, establishment and growth. Warm season grasses, however, such as saltgrass, germinate and grow most vigorously when temperatures are warming and days are lengthening. The best time to plant warm season grass seed (i.e., in flats or in the ground) is late spring or early summer.

Material Acquisition

Unfortunately for the saltgrass plantings in question, the contract with the nursery was established late in the season (third week of August). As a consequence, the supplier sowed the seed later than the optimal time. In addition, the ensuing fall/winter/spring of the 1998/99 was unusually long and cool. These two events, but in particular the cool weather, contributed to the delay in the saltgrass establishment at the nursery. There was insufficient "lead-time" to provide insurance against the unknown variable of weather.

Maintenance

Maintenance in the form of watering became a problem for the subject sites since the rainfall this season was less than normal and the sites were planted later than anticipated, and could not benefit from early season rains. If plantings of well rooted saltgrass had been installed during the period of the early rains (November), minimal establishment irrigation would have been necessary; a minimum provision for watering would have been required during installation. Optimally, well rooted flats of sod would be planted in November, at the start of the rainy season, watered-in during planting and then only watered again if no rains occur within the first one to two weeks after planting.

Recommendations for Future Plantings

If future plantings are desired, the following planning process is highly recommended to avoid the problems encountered in the Pilot Program.

- **Material Acquisition:** Allow one-year in advance of a fall planting time for contract growing of the saltgrass material. One year should provide sufficient time to obtain adequate quantities of seed, give the grower time to gear-up operations, plant the seed in late spring or early summer depending on the weather, and germinate/establish the saltgrass in either flats or in the ground (if feasible) in time for fall delivery. Plantings of well established sod should be optimally timed to occur in November.
- **Water Supply:** Ensure that an adequate water supply will be available at or near the plantings sites in case sufficient rain does not occur during the establishment period of the plantings.
- **Maintenance:** Contract with a landscape firm qualified to perform timely site preparation, installation and maintenance. Include long-term (6 to 12 months) performance standards to ensure contractor responsibility for establishment of the plantings.

Despite the problems encountered, it is anticipated that the plantings will fill in and provide the desired ground cover and filtering function originally envisioned. It is important to remember that plant growth is strongly influenced by the variables of rainfall, temperatures and soil conditions. With continued irrigation and more warm weather, the project will fulfill its intended purpose.

TABLE 1

PLANT SPECIES SUITABLE FOR BIO-FILTER PLANTINGS

Genus species	**Common Name**	**Life Form**	**Height**	**Origin/Range**
Bromus carinatus	California brome	grass, perennial, short-lived (± 2 years)	18" - 36"	Western US, British Columbia to Central America
Deschampsia caespitosa	Tufted hairgrass	grass, perennial, clumping	12" - 30"	North America
Distichlis spicata	Saltgrass	grass, perennial, rhizome/stolon forming	6" - 20"	North America to South America
Elymus glaucus	Blue wildrye	grass, perennial, clumping	18" - 36"	Alaska to Baja California
Hordeum brachyantherum	Meadow barley	grass, perennial, clumping	12" - 18"	North America to Baja California
Leymus triticoides "Rio"	Creeping wildrye	grass, perennial, creeping rhizomes	18" - 36"+	Western US and Baja California
Lupinus bicolor	Pygmy-leaf lupine	legume, annual	4" - 12"	California deserts, mountains and coastal areas
Nasella lepida	Foothill needlegrass	grass, perennial, clumping	12" - 24"	Northern California to Baja California
Nasella pulchra	Purple needlegrass	grass, perennial, clumping	12" - 24"	Northern California to Baja California
Trifolium willdenovii	Tomcat clover	legume, annual	4" - 16"	Western North America

MEMORANDUM

To: Steve Borroum JN 10-034123.001

From: John Andrew, Scott Taylor

Date: May 18, 1999

Subject: **Caltrans Storm Water Management BMP Retrofit Pilot Program - Los Angeles and San Diego County Biofiltration Sites**

On May 15, 1999 RBF inspected the five saltgrass biofilter sites in Los Angeles County and two in San Diego County. Find attached photographs for each of the sites. The purpose of the inspection was to quantify saltgrass growth, assess work efforts to date and determine work future efforts to insure our goal of 90% coverage. A summary of the inspection is as follows:

District 7

Altadena MS (Strip): Site is currently covered by approximately 40% saltgrass with growth concentrated at the outlet. This site is in good condition and we should expect full coverage with continued regular irrigation.

I-5/I-605 (Swale): Site is covered by less than 20% saltgrass with growth concentrated at outlet side of swale and at base of an existing sprinkler head. The sprinkler system at this site has been repaired and RBF will plug with additional saltgrass during the week of 5/31. Irrigation to continue.

SR 91/I-605:

Cerritos MS/SR 91 (Swale): Site is covered by less than 30% saltgrass. This site needs more irrigation and supplemental plugging of saltgrass. RBF will plug with additional saltgrass during the week 5/31.

North Bound Ramp from I-605 to SR 91 (Swale): Two-thirds of site is covered by 80% saltgrass, one third less than 30%. This site is in very good condition and we should expect full coverage with continued irrigation.

North Bound 91'(Strip): This site is very close to achieving the goal of 90% coverage. Irrigation will continue until full 90% coverage is achieved.

I-605 Del Amo:

Site is covered by less than 20% saltgrass with growth concentrated at inlet and outlet side of the swale. RBF will plug with additional saltgrass during the week of 5/31.

District 11

Carlsbad Maintenance Station: Site is currently covered by approximately 70% saltgrass. This site is in good condition and we should expect full coverage with continued regular irrigation.

Melrose Drive: Site is currently covered by approximately 70% saltgrass although much of the site remains in a 'dormant' state. This site is in good condition and we should expect full coverage with continued regular irrigation. Plugs of saltgrass will be taken from the side slope areas (above the active flow area) and placed in the invert to speed coverage.

See attached photo files, San Diego.doc and Los Angeles.doc.

I-605 NB Strip

Altadena MS

I-605-Del Amo

I-605 Del Amo

I-5/I-605

Cerritos Maintenance Station

I-605/SR 91 Swale

Carlsbad MS

Carlsbad MS

Melrose Drive Swale

APPENDIX I:

BIOLOGICAL ASSESSMENT/SURVEY BY DUDEK

DUDEK & ASSOCIATES, INC.
Professional Teams for Complex Projects

Engineering, Planning, Environmental Sciences and Management Services

Corporate Office:
605 Third Street
Encinitas, California 92024

760.942.5147
Fax 760.632.0164

9 June 1999

2195-01

Trevor Smith
RBF & Associates
14725 Alton Parkway
Irvine, CA 92618-2069

Subject: ***Caltrans Best Management Practices Pilot Study - Endangered, Threatened, and Sensitive Species and Review of BMP Maintenance Plan***

Dear Mr. Smith:

This letter is intended to address issues regarding state- and federally-listed threatened and endangered species, species which are considered sensitive by various agencies but are not subject to legal protection, and a review of the BMP Maintenance Plan as they relate to continued maintenance of the BMP sites and endangered species issues. Considerations regarding sensitive resource issues and recommendations are based on the biologists best professional judgement.

Sensitive biological resources present or potentially present on the sites were identified through a literature search using the following sources: U.S. Fish and Wildlife Service (1989, 1990, 1991, 1993), California Department of Fish and Game (1980, 1986, 1987), and the vegetation and sensitive species mapping performed for the Multiple Species Conservation Program (MSCP). General information regarding wildlife species present in the region was obtained from Unitt (1984), Bent (1961,1962 1963, 1968), Ehrlich (1988), Garrett and Dunn (1981) and Ziener et al. (1990) for birds; Bond (1977), Ziener et al. (1990), Ingles (1965), Jameson and Peters (1986), and Chapman and Feldhamer (1982) for mammals; Stebbins (1985), Zeiner et al. (1988), Brown (1974), Dickerson (1969) for reptiles and amphibians; Emmel and Emmel (1973) and Brown et al. (1992) for butterflies; and U.S. Fish and Wildlife Service (1997) and Eng et al. (1990) for fairy shrimp.

POTENTIAL EFFECT ON BMP OPERATIONS

There are only a few native wildlife and plant issues that currently may have an affect on the normal operation of the BMP sites. These issues include potential impacts to state- and federally-listed threatened and endangered species. California species of special concern, state and federally proposed species, rare species, and species listed as otherwise sensitive by local or regional resource agencies do not have legal status with regard to this project, unless there are nesting bird species. However, they are addressed herein because some may be listed in the future and would then be subject to legal protection.

Federally-listed threatened and endangered plant species would not affect the project because they are only regulated when part of a Federal action.

THREATENED AND ENDANGERED SPECIES

Based on the locations of the BMPs, proposed hydrology regimes of the BMPs, proposed maintenance schedule of the BMPs, present habitat on the BMPs, proximity of the BMPs to suitable habitat, and known habitat preferences of each species, only 7 threatened and endangered wildlife species have any potential for occurrence on the BMP sites. These include: Pacific pocket mouse (*Perognathus longimembris pacificus*), light-footed clapper rail (*Rallus longirostris levipes*), California least tern (*Sterna antillarum browni*), western snowy plover (*Charadrius alexandrinus nivosus*), Belding's Savannah sparrow (*Passerculus sandwichensis beldingi*), Riverside fairy shrimp (*Streptocephalus wootoni*), and San Diego fairy shrimp (*Branchinecta sandiegoensis*). One other federally-listed endangered species, the quino checkerspot butterfly (*Euphydryas editha quino*) is a highly unlikely colonizing candidate as there are no known urban loci and it requires relatively dense and persistent patches of dwarf plantain (*Plantago erecta*). A number of state- and federaly-listed threatened and endangered species do not have any reasonable likelihood of occupance on the BMP sites, including:arroyo toad (*Bufo microscaphus*), California red-legged frog (*Rana aurora draytona*), rubber boa (*Charina bottae*), bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), California gnatcatcher (*Polioptila californica californica*), least Bell's vireo (*Vireo belli pusillus*), southwestern willow flycatcher (*Empidonax trailli extimus*), yellow-billed cuckoo (*Coccyzus americanus*), and Stephens' kangaroo rat (*Dipodomys stephensi*). Furthermore, the federally proposed Santa Ana sucker (*Catastomus santaanae*) and mountain plover (*Charadrius montanus*) would not occur on the BMP's.

A brief discussion of each likely invading species follows. Table 1 indicates which BMP sites these species may realistically pose a concern. Similar habitat species are grouped.

Table 1
Possibly Invading Threatened and Endangered Species By Location With Inhibitors

Location;BMP Type	Snowy Plover, Least Tern [1B,F]	Savannah Sparrow [2b,F]	Riverside Fairy Shrimp, San Diego Fairy Shrimp [3]
I-605/SR-91; InfBa			X
I-5/I-605; ExtDB			X
I-605/SR-91; ExtDB			X
I-605/SR-91; BiofSw			X
Cerritos MS; BiofSw			X
I-5/I605; BiofSw			X
I-5/Del Amo; BiofSw			X
I-5/Manchester; ExtDB		X	X
I-5/SR-56; ExtDB		X	X
I-15/SR-78; ExtDB			X
I-5/LaCosta SE; WetBa			X
SR-78/Melrose; BiofSw			X
I-5/Palomar Airport; BiofSw			X

Location;BMP Type	Snowy Plover, Least Tern [1B,F]	Savannah Sparrow [2b,F]	Riverside Fairy Shrimp, San Diego Fairy Shrimp [3]
I-5/LaCosta P&R; MedFi	X	X	X
I-5/SR-78 P&R; MedFi	X		X

InfBa - Infiltration Basin
ExtDB - Extended Detention Basin
BiofSw - Biofiltration Swale
WetBa - Wet Basin
MedFi - Media Filter

1 - Do not allow pickleweed to colonize
2 - Reduce amount of bare substrate/Place mesh over basins and media filters
3 - Do not allow standing water (0 to 12 inches deep) to persist longer than 7 days
B - Breeding Habitat
F - Foraging Habitat

Pacific Pocket Mouse
Pacific pocket mouse inhabits open, sparsely vegetated coastal sage scrub, coastal strand, coastal dune, and river alluvium habitats on fine-grain, sandy substrates. It has been detected up to 2.5 miles from the coast. The subspecies is currently known to occur at the Dana Point Headlands, Orange County, and two locations on the Marine Corps Base, Camp Pendleton, San Diego County. It currently occupies approximately 1,000 acres. Historical, presumably extirpated, populations have been known from Marina Del Rey (1918-1938), Clifton (1931), and Wilmington (1865), Los Angeles County, Newport Beach (1968-1971), Orange County, and Los Penasquitos Lagoon (1933-1935) and Lower Tijuana River (1894-1932), San Diego County.

This species is realistically not expected to occur on any of the BMP sites because of its limited distribution and habitat management as implemented by the Maintenance Plan. Known locations are more than 15 miles from the closest BMP site. It is unlikely that pocket mice would be able to travel that distance, across urban landscapes, and colonize a site which has been disturbed.

Light-footed Clapper Rail
The light-footed clapper rail utilizes coastal saline emergent wetlands and adjacent sloughs and mudflats throughout most of the year, however they have also been known to use freshwater and brackish-water marshes. The rail may also use the ecotone between wetland and adjacent upland habitats, particularly when forced out of the marshes during high tides. It nests mostly in the lower zones of saline emergent wetlands, where cordgrass and tidal sloughs are proximal. The nest is a platform concealed by a canopy of woven cordgrass.

Because all sites, other than the Wet Basin BMP, would not be allowed to support emergent vegetation, this species is not expected to occur on the BMP sites (except for the Wet Basin) due to an absence of appropriate habitat. They are not expected to breed at the Wet Basin BMP because the relatively small site is isolated from suitable habitat by a large and busy road, however they may occasionally find the site and use it to forage or loaf during high tide events.

Western Snowy Plover
Western snowy plover utilizes sandy marine and estuarine shores. Most of their nesting now occurs on salt pond levees and manufactured beaches. It requires a sandy, gravelly, or friable soil substrate for nesting. The nest is a shallow depression which is sometimes lined by small pebbles or gravel. The nest may be located near or under driftwood, rocks, or defoliated bushes. They nest from April through August.

This species can be discouraged by planting bare substrate areas where possible and if practicable, by installing nylon or plastic mesh with Mylar or foil strips over Media Filters. Larger BMP's such as Infiltration/Detention Basins and Wet Basins will require alternative methods to discourage usage such as attaching foil or mylar strips to stakes and placing the stakes at intervals within the BMP's and/or placing scarecrow devices around the BMP's , or simply waiting until after the breeding season to conduct maintenance activities.

California Least Tern

California least tern utilizes marine and estuarine shores and beaches and feeds in nearby shallow estuarine waters. They nest in loose colonies in areas free of human disturbance, on bare or sparsely vegetated sandy or gravelly substrate. They breed from April through August.

This species can be discouraged by planting bare substrate areas where possible and if practicable, by installing nylon or plastic mesh with Mylar or foil strips over Media Filters. Larger BMP's such as Infiltration/Detention Basins and Wet Basins will require alternative methods to discourage usage such as attaching foil or mylar strips to stakes and placing the stakes at intervals within the BMP's and/or placing scarecrow devices around the BMP's , or simply waiting until after the breeding season to conduct maintenance activities.

Belding's Savannah Sparrow

The Belding's Savannah sparrow mainly utilizes pickleweed in saline emergent wetlands. This ground nester requires dense ground cover during the breeding season. It builds a small cup-shaped nest out of grasses, sedges, and pickleweed that sits on the ground and is concealed by overhanging vegetation. This species usually breeds from April to August.

This species can be discouraged by removing any pickleweed which colonizes BMP sites proximal to bays and estuarine areas and replanting with the approved seed mix.

San Diego Fairy Shrimp

San Diego fairy shrimp are known from a wide variety of seasonal pool types and depths. They are found in natural vernal pools associated with natural depressions or basins, but are as frequently found in road ruts and disturbed ponds with turbid water. This fairy shrimp usually can be found between January to March depending on weather. It is thought that this species can be translocated by machinery, livestock, and waterbirds.

This species can be discouraged by not allowing water to stand for more than 7 days.

Riverside Fairy Shrimp

Riverside fairy shrimp are typically found in deep, cool, seasonal pools of water, usually associated with tectonic swales or earth slump basins in patches of grassland and agriculture interspersed in coastal sage scrub vegetation, however it is also found in a variety of disturbed habitats such as road ruts, ditches, and stock ponds. These pools are filled by winter and spring rains and generally last into April or May. They occur in turbid or clear water and may or may not have perimeter vegetation. It is thought that this species may be transported to new ponds by machinery, livestock and waterbirds.

This species can be discouraged by not allowing water to stand for more than 7 days.

SENSITIVE SPECIES

Based on the locations of the BMPs, proposed hydrology regimes of the BMPs, proposed maintenance schedule of the BMPs, present habitat on the BMPs, proximity of the BMPs to suitable habitat, and known habitat preferences of each species, twenty (20) species listed as "species of special concern," former Catagory 1 or 2 candidates, or species designated as sensitive by local or regional resource agencies have any potential for occurrence on the BMP sites. These include: saltmarsh skipper (*Panoquina errans*), southwestern pond turtle (*Clemmys marmorata*), orange-throated whiptail (*Cnemidophorus hyperythrus*), western whiptail (*Cnemidophorus tigris*), San Diego ringneck snake (*Diadolphis punctatus*), western spadefoot toad (*Scaphiopus hammondi*), white-faced ibis (*Plegadis chihi*), double-crested cormorant (*Phalacrocorax auritis*), reddish egret (*Egretta rufescens*), elegant tern (*Sterna elegans*), grasshopper sparrow (*Ammodramus savannarum*), tricolored blackbird (*Agelaius tricolor*), northern harrier (*Circus cyaneus*), burrowing owl (*Athene cunicularia*), California horned lark (*Eremophila alpestris*), northwestern San Diego pocket mouse (*Chaetodipus fallax fallax*), and San Diego black-tailed jackrabbit (*Lepus californicus bennetti*). A number of regionally sensitive species do not have any reasonable likelihood to occupy and be affected by maintenance at the BMP sites, including: Harbison's dun skipper (*Euphys vestris harbosoni*), arroyo chub (*Gila orcutti*), large-blotched salamander (*Ensatina eschscholtzii*), coast range newt (*Taricha tarosa*), San Diego banded gecko (*Coleonyx variagatus*), northern red-diamond rattlesnake (*Crotalus ruber ruber*), San Diego mountain kingsnake (*Lampropeltis zonata pulchra*), Cooper's hawk(*Accipiter cooperi*), sharp-shinned hawk (*Accipiter striatus*), ferruginous hawk (*Buteo regalis*), Swainson's hawk (*Buteo swainsoni*), golden eagle (*Aquila chrysaetos*), southern California rufous-crowned sparrow (*Aimophila ruficeps*), coastal cactus wren (*Campylorhynchus brunneicappilus*), western bluebird (*Sialia mexicana*), yellow warbler (*Dendroica petechia*), yellow-breasted chat (*Icteria virens*), purple martin (*Progne subis*), merlin (*Falco columbarius*), Bell's sage sparrow (*Amphispiza belli*), San Diego desert woodrat (*Neotoma lepida*), American badger (*Taxidea taxus*), and mountain lion (*Felis concolor*).

A brief discussion of each likely invading species follows. Table 2 indicates the BMP sites where species may realistically pose a concern. Similar species are grouped.

Saltmarsh Skipper
The salt marsh skipper is a medium-small, olive-brown butterfly that is restricted to the narrow coastal margin from about Santa Barbara County south to the southern tip of Baja California, Mexico (MacNeill 1962; Donahue 1975). It is represented by a series of disjunct and isolated populations confined to coastal estuarine or salt marsh habitats. The single larval host is salt grass (*Distichlis spicata*) with which adults are commonly associated (Emmel and Emmel 1973; Brown 1981). Owing to the apparently tolerant and invasive nature of salt grass, some colonies of the salt marsh skipper have managed to persist despite limited habitat alteration. Nectar sources for the skipper include heliotrope (*Heliotropium curvassavicum*), salty susan (*Jaumea carnosa*), sea rocket (*Cakile maritima*), deerweed (*Lotus scoparius*) and frankenia (*Frankenia salina*) (Brown 1981; Busnardo 1989). The flight period of the salt marsh skipper extends from March or April to October in most years, in a series of overlapping generations. Population density reaches its highest in mid-to-late summer. The salt marsh skipper is resident in several protected areas in southern California. Because of the reduction in acreage of the salt marsh habitat in southern California, the salt marsh skipper is considered highly sensitive. Populations of the skipper are disappearing rapidly in Baja California as coastal marshes are being altered for salt production and other developments.

Table 2
Possibly Invading Threatened and Endangered Species By Location With Inhibitors

Location;BMP Type	San Diego Pocket Mouse	Elegant Tern	Saltmarsh Skipper, White-faced Ibis, Reddish Egret	Pond Turtle, Western Spadefoot, Double-crested Cormorant, Tricolored Blackbird, Northern Harrier	Grasshopper Sparrow, Burrowing Owl, California Horned Lark	Blacktailed Jackrabbit	Orange-throated Whiptail, Western Whiptail, Ringneck Snake
I-605/SR-91; InfBa					X		
I-5/I-605; ExtDB					X		
I-605/SR-91; ExtDB					X		
I-605/SR-91; BiofSw					X		
Cerritos MS; BiofSw					X		
I-5/I605; BiofSw					X		
I-5/Del Amo; BiofSw					X		
I-5/Manchester; ExtDB					X		X
I-5/SR-56; ExtDB	X	X	X		X	X	X
I-15/SR-78; ExtDB					X		X
I-5/LaCosta SE; WetBa	X	X	X	X	X		X
SR-78/Melrose; BiofSw					X		X
I-5/Palomar Airport; BiofSw					X		X

Location;BMP Type	San Diego Pocket Mouse	Elegant Tern	Saltmarsh Skipper, White-faced Ibis, Reddish Egret	Pond Turtle, Western Spadefoot, Double-crested Cormorant, Tricolored Blackbird, Northern Harrier	Grasshopper Sparrow, Burrowing Owl, California Horned Lark	Blacktailed Jackrabbit	Orange-throated Whiptail, Western Whiptail, Ringneck Snake
I-5/LaCosta P&R; MedFi	X	X			X		X
I-5/SR-78 P&R; MedFi					X		X

InfBa - Infiltration Basin
ExtDB - Extended Detention Basin
BiofSw - Biofiltration Swale
WetBa - Wet Basin
MedFi - Media Filter

Potential for this species to occur on the BMP sites can be eliminated by precluding and eradication of salt grass. New plant ground cover would need to be planted to perform the same function. It may be more appropriate to implement this in future projects.

Southwestern Pond Turtle

The pond turtle is associated with permanent or nearly permanent water bodies in a wide variety of habitat types. It also utilizes adjacent upland habitats to lay eggs, sometimes traveling 2 to 3 kilometers. This omnivore requires basking sites such as partially submerged logs and rocks or mud banks.

This species can only occur where there are permanent water bodies, such as Wet Basins. Although it is possible that an errant turtle could attempt to nest in the upland portion of a BMP, this is highly unlikely because distances from known populations generally are greater than 2 to 3 kilometers and travel toward the BMP's is very hazardous through urban habitat. Other types of BMP's would not be at risk for this species if they are maintained according to the Maintenance Plan and standing water is not allowed to persist. Though all risk of colonization can not be eliminated on Wet Basin BMP's due to their nature, risk may be reduced by removing floating debris and dead and floating vegetation mats from within the water body.

Orange-throated Whiptail

The orange-throated whiptail lizard (*Cnemidophorus hyperythrus*) is a small, slender, insectivorous lizard with a bright orange patch on its throat. It occurs in the United States and Mexico, ranging from coastal southern California south to the tip of the peninsula of Baja California. This species has exhibited population declines in California associated with the conversion of coastal sage scrub and dry wash habitats for agriculture, urban development, and flood control. An active forager, the orange-throated whiptail frequents dry, often rocky hillsides, ridges, valleys, and washes that support broken coastal sage scrub, chaparral, mule fat scrub, and grassland mixed with sage scrub species. It often occurs with the more common western whiptail (*C. tigris*). The orange-throated whiptail relies to some extent on the burrows of small mammals, such as the California ground squirrel (*Spermophilus beecheyi*), for protection from predators and adverse environmental conditions.

This species may be present near any of the San Diego BMP sites listed in this report, as it can be common along road sides and other disturbed areas adjacent to intact upland habitats. Control of insect and arthropod prey and ensuring dense ground cover will make the sites less attractive to orange-throated whiptails.

Western Whiptail

The coastal western whiptail is a moderately large, slender lizard typically found in semiarid areas or where the vegetation is sparse. It eats insects, spiders, scorpions, and lizards. It is restricted to the western coast of North America from about Ventura County, California, south through the northern two-thirds of the peninsula of Baja California. This species apparently has declined in California as a result of loss of habitat to urban development.

This species may be present near any of the San Diego BMP sites listed in this report, as it can be common along road sides and other disturbed areas adjacent to intact upland habitats. Control of arthropod and insect prey and ensuring dense ground cover will make the sites less attractive to western whiptails.

San Diego Ringneck Snake
The San Diego ringneck snake occurs in moist areas within forests, chaparral, grasslands, disturbed areas, logs, rocks, bark or other sheltering features. They are seldom seen, but rather found under cover logs, rocks, boards, and other ground debris.

While this species may come across any of the San Diego BMP sites listed in this report, and may even take up residence, it can be discouraged by eliminating diurnal cover sites such as boards, rocks, logs, and woodpiles.

Western Spadefoot
According to Stebbins (1985), the western spade-foot toad is primarily a species of lowlands, frequenting washes, floodplains of rivers, alluvial fans, playas, and alkali flats, but also ranges into the foothills and mountains. It prefers areas of open vegetation and short grasses where the soil is sandy or gravelly. It breeds during the winter (January-May) in quiet streams, ephemeral ponds, and vernal pools. During the unfavorable, dry portion of the year, the toads live beneath the soil surface in burrows.

This species is usually not associated with permanent water bodies, so Wet Basin BMP's should not be at risk. As long as Infiltration Basin BMP's and Detention Basin BMP's are maintained according to the Maintenance Plan and puddles are not allowed to persist, those BMP's should not be at risk.

White-faced ibis
This species mainly visits southern California during migration and over-winter. It rarely breeds in southern California. They rely on marshes, ponds, lakes, rivers, flooded fields, and estuaries for foraging opportunities. Extensive marshes are required for nesting (Garrett and Dunn 1981).

Since 1901, there has only been one known nesting colony in San Diego County in 1979, this at Buena Vista Lagoon (Unitt 1984). Because of this and the character of the BMP sites, it is highly unlikely that any BMP site would be colonized by breeding ibis. It is plausible, however that the BMP sites marked in Table 2 could be utilized by migratory ibis for foraging purposes, especially at the SR-56/I-5 BMP where they have been observed by Dudek in adjacent wetland habitats.

Double-crested Cormorant
This species is a common to very common non-breeding visitor in San Diego County (Unitt 1984). It is most common on bays, lagoons, and estuaries along the coast (Unitt 1984), but also may be encountered on ponds at inland localities. The only known breeding occasions for San Diego, were in 1928 and 1932. These occurred in isolated coastal cliff situations.

Because of its nesting status and the character of the BMP sites, it is improbable that any BMP site could be colonized by breeding cormorants. However, BMP's with standing water could encourage foraging for fish. Mylar or foil strips attached to stakes at the Wet Basin BMP and following the Maintenance Plan by not allowing standing water at other BMP's may deter foraging cormorants.

Reddish Egret
This irregular migrant is not known to breed in southern California. This species mainly forages in wetland habitats on fish and invertebrates, but may also forage in upland habitats in search of small rodent prey.

BMP's with standing water could encourage foraging, therefore, placement of Mylar or foil strips attached to stakes and placed around the Wet Basin BMP and following the Maintenance Plan by not allowing standing water at other BMP's should reduce the chance of foraging attempts by reddish egrets. Potential upland foraging cannot be prevented unless continued rodent eradication is practiced.

Elegant Tern

Elegant terns utilize marine and estuarine shores and beaches and feed in nearby shallow estuarine waters. They nest in colonies in areas free of human disturbance, on bare or sparsely vegetated sandy or gravelly substrate. Only a few nesting colonies are known in southern California where they breed from March through mid-June. By July they can be found along the entire coast and in all large river mouths.

This species can be discouraged by planting bare substrate areas where possible and if practicable, by installing nylon or plastic mesh with Mylar or foil strips over Media Filters. Larger BMP's such as Infiltration/Detention Basins and Wet Basins will require alternative methods to discourage usage such as attaching foil or mylar strips to stakes and placing the stakes at intervals within the BMP's and/or placing scarecrow devices around the BMP's, or simply waiting until after the breeding season to conduct maintenance activities.

Grasshopper Sparrow

This local breeding species heavily depends on grassy slopes and mesas. The small bird is easily detected during the breeding season.

While it is highly unlikely that grasshopper sparrows will colonize any of the BMP sites, potential impacts to breeding members of this species can be eliminated by cutting vegetation around the BMP sites during the sparrows' non-breeding season (August to February).

Tricolored Blackbird

This species relies on emergent freshwater marsh habitat as breeding habitat. The colonial nester builds its nest in the reed or cattail curtain surrounding ponds and other freshwater areas.

Breeding members of this species is only likely to nest on BMP sites that have extensive emergent wetland vegetation (i.e., Wet Basin BMP's). Other sites, including Infiltration Basin BMP's and Detention Basin BMP's, would not be colonized by breeding tricolored's if they are maintained according to the Maintenance Plan and emergent wetland vegetation is not allowed to grow. Impacts to breeding tricolored's can be avoided by implementing maintenance activities in the Wet Basin, as directed by the Maintenance Plan, during the non-breeding season (August to February). Foraging individuals can occur on any site, particularly in lawn-like areas and little can be done to control them.

Northern Harrier

The northern harrier ranges throughout California and may be encountered in grasslands, open fields, and salt and freshwater marshes. According to Unitt (1984), the northern harrier is an uncommon- to-fairly common migrant and winter visitor in San Diego County, and a rare and local summer resident. The schedule of their migrations is poorly understood. Northern harriers breed in grasslands and marshes.

This species may forage over the larger BMP sites (i.e., Wet Basin, Infiltration Basin, Detention Basin BMP's) but is unlikely to nest on any of them. Removal of emergent wetland vegetation from all BMP sites, except Wet Basins, will eliminate nesting resources for harriers. The urban setting of the Wet Basin BMP site will discourage nesting by harriers.

Burrowing Owl
The burrowing owl is considered sensitive throughout California where it burrows, because of loss of habitat, poisoning, and predation by dogs and cats. It is typically uncommon throughout the state but is locally common in some areas, particularly Imperial County where it reaches peak abundance levels (Garret & Dunn, 1981). This species relies on the burrows of fossorial mammals, natural crevases, and partially buried pipes and other man-made structures for cover and nesting sites.

The potential exists for burrowing owls to colonize the vicinity of any of the BMP sites. Control of erosion created fissures or holes, California ground squirrel, and other fossorial mammal burrows and covering of all pipes, holes, or other orifices, 4 to 12 inches in diameter around or in BMP sites should eliminate potential cover and nesting sites.

Southern California Horned Lark
This species is resident primarily in open, sparsely vegetated habitats such as disturbed fields and grasslands. Unitt (1984) indicates that this species is a common breeding resident and an abundant migrant and winter visitor in San Diego County.

Because this species uses open, disturbed, and grassy areas, it is unlikely that any measure could reduce the potential for occasional foraging and even breeding use of the BMP sites.

Northwestern San Diego Pocket Mouse
The northwestern San Diego pocket mouse inhabits sparse or disturbed coastal sage scrub or grasslands with sandy soils. This species was recently added to the federal candidate list because of threats to its habitat by development. In San Diego County, it is known from Del Mar, Dulzura, Jacumba, Lake Hodges, Pala, San Diego, and San Marcos (Bond 1977).

The species is likely to occur near the BMP sites listed in Table 2 and suitable soils exist on the BMP sites. However, because of the history of disturbance at the BMP sites, continued maintenance, urban setting, and expected regular presence of cats, it is unlikely that successful colonization will occur.

San Diego Blacktailed Jackrabbit
The black-tailed jack rabbit is the largest rabbit in southern California. It occurs primarily in open or semi-open country (Bond 1977). The San Diego black-tailed jack rabbit (*Lepus californicus bennettii*) is found in the Upper Sonoran life zone along the coast to the western base of the coastal mountains, from sea level to 6,000 feet on Cuyamaca Peak.

The only BMP site which may be occasionally used by jackrabbit is the site located at Interstate 5 and State Route 56 as they have been observed by Dudek in the adjacent open space preserve. All other sites are very distant from occupied habitat areas. It is improbable that they would breed on the BMP site because of lack of adequate cover. Because the species currently has no legal protection, immediate action is not necessary but should be considered in the future. Usage of the site could be reduced by using rabbit exclusion fencing. This is accomplished by placing a continuous perimeter of woven wire or poultry netting fence material with a mesh no larger than 3.8 centimeters, 91 to 121 centimeters high, with the bottom turned 15 centimeters outward and buried at least 15 centimeters below ground.

PREVENTIVE MEASURES

A few measures may be used in order to reduce or eliminate the possibility of certain sensitive species from colonizing the BMP sites. These include:

- Do not allow pickleweed (*Salicornia* sp.) to colonize sites proximate to bays and estuarine areas, this will virtually eliminate the possibility of colonization by Belding's Savannah sparrow.

- Do not allow salt grass (*Disticilis spicata*) on any coastal BMP site. This will eliminate the possibility of colonization by salt marsh skipper.

- Do not allow dwarf plantain (*Plantago erecta*) to colonize any BMP site. This will eliminate the chance of quino checkerspot butterfly (*Euphydryas editha quino*) colonization

- Do not allow coastal sage scrub shrub species or other shrub species to be hydroseeded or colonize the BMP sites. This will virtually eliminate the possibility of nesting by California gnatcatcher (*Polioptila californica*) and other shrub nesting species.

- Remove all willow, mulefat, and emergent wetland vegetation as it grows. This will eliminate the possibility of nesting by least Bell's vireo (*Vireo bellii pusillus*), southwestern willow flycatcher (*Empidonax traillii extimus*) and a number of other bird species.

- Do not allow erosion created fissures or holes to persist; any pipes, holes, or other orifices, 4 to 12 inches in diameter, should be screened or covered; do not allow California ground squirrels or other fossorial mammals to dig burrows around or in BMP sites. These measures are intended to reduce the likelihood of colonization by burrowing owls, because they typically do not dig their own burrows.

- Consider placing a rabbit exclusion fence at the I-5/SR-56 Extended Detention Basin to exclude blacktailed jackrabbit. This fence should be of woven wire or poultry netting that has mesh material no greater than 3.8 centimeters. The mesh should be 91 to 121 centimeters tall above ground, and the bottom should be turned 15 centimeters outward and buried 15 centimeters below ground.

BMP MAINTENANCE PLAN REVIEW

The BMP Maintenance Plan generally is adequate for reducing potential for wildlife conflicts at the sites. We offer the following recommendations to further reduce Caltrans' exposure to wildlife issues:

- BIOFILTER - STRIPS and SWALES – Change the monitoring for evidence of channeling or ponding to weekly, instead of monthly, during the rainy months.

- BIOFILTER - STRIPS and SWALES – Remove all woody vegetation, shrubs, plantain, pickleweed, and wetland emergent vegetation.

- BIOFILTER - STRIPS and SWALES – Cover all pipes or holes 4 to 12 inches in diameter, and do not allow California ground squirrels or other fossorial mammals to dig burrows on or around the BMP site.

- EXTENDED DETENTION BASINS – Do not allow standing puddles to persist longer than 7 days.

- EXTENDED DETENTION BASINS – Remove all woody vegetation, shrubs, plantain, pickleweed, and wetland emergent vegetation.

- EXTENDED DETENTION BASINS – Plant bare substrate areas where possible and attaching foil or mylar strips to stakes and placing the stakes at intervals within the BMP and placing scarecrow devices around the BMP, or simply waiting until after the breeding season to conduct maintenance activities.

- EXTENDED DETENTION BASINS – Cover all pipes or holes 4 to 12 inches in diameter, and do not allow California ground squirrels or other fossorial mammals to dig burrows on or around the BMP site.

- INFILTRATION BASINS – Do not allow standing puddles to persist longer than 7 days.

- INFILTRATION BASINS – Remove all woody vegetation, shrubs, plantain, pickleweed, and wetland emergent vegetation.

- INFILTRATION BASINS – Plant bare substrate areas where possible and attaching foil or mylar strips to stakes and placing the stakes at intervals within the BMP and placing scarecrow devices around the BMP, or simply waiting until after the breeding season to conduct maintenance activities.

- INFILTRATION BASINS – Cover all pipes or holes 4 to 12 inches in diameter, and do not allow California ground squirrels or other fossorial mammals to dig burrows on or around the BMP site.

- MEDIA FILTERS - SAND - Cover all sand pits with a canopy of nylon or plastic mesh with Mylar and foil strips during the breeding season.

- WET BASINS – Do not allow standing puddles, 1 to 12 inches deep to persist longer than 7 days. However, pools greater than 1-foot in depth should not harbor threatened or endangered species.

- WET BASINS – Conduct all maintenance within the wet zone during the non-breeding season, including a 20-foot buffer around the water line.

- WET BASINS – Plant bare substrate areas where possible and attaching foil or mylar strips to stakes and placing the stakes at intervals within the BMP and placing scarecrow devices around the BMP, or simply waiting until after the breeding season to conduct maintenance activities.

- WET BASINS – Cover all pipes or holes 4 to 12 inches in diameter, and do not allow California ground squirrels or other fossorial mammals to dig burrows on or around the BMP site.

Recommended BMP maintenance measures by location and type are presented in Table 3.

Table 3
Maintenance Methods by BMP Location and Type

Location;BMP Type	[1]No Emergent Vegetation	[2]Plant Bare Areas	[3]Place Mesh	[4]Foil on Stakes	[5]No Pickleweed	[6]No Standing Water	[7]No Saltgrass	[8]No Floatng Debris	[9]Plant Dense Ground Cover	[10]No Woodpiles	[11]Cut Upland Vegetation Between Augast and February	[12]Cut Wetland Vegetation Between August and February	[13]Close All Holes	[14]Place Jackrabbit Fence	[15]Do Not Plant Shrubs
I-605/SR-91; InfBa						X					X		X		X
I-5/I-605; ExtDB						X					X		X		X
I-605/SR-91; ExtDB						X					X		X		X
I-605/SR-91; BiofSw						X					X		X		X
Cerritos MS; BiofSw						X					X		X		X
I-5/I605; BiofSw						X					X		X		X
I-5/Del Amo; BiofSw						X					X		X		X
I-5/Manchester; ExtDB	X	X		X	X	X	X		X	X	X		X		X
I-5/SR-56; ExtDB	X	X		X	X	X	X		X	X	X		X	X	X
I-15/SR-78; ExtDB	X			X		X			X	X	X		X		X
I-5/LaCosta W; InfBa	X	X		X	X	X	X		X	X	X		X		X
I-5/LaCosta SE; WetBa		X		X	X		X	X	X	X	X	X	X		X
SR-78/Melrose; BiofSw						X			X	X	X		X		X
I-5/Palomar Airport; BiofSw						X			X	X	X		X		X
I-5/LaCosta P&R; MedFi		X	X			X			X	X	X		X		X
I-5/SR-78 P&R; MedFi			X			X			X	X	X		X		X

InfBa - Infiltration Basin
ExtDB - Extended Detention Basin
BiofSw - Biofiltration Swale
WetBa - Wet Basin
MedFi - Media Filter

1. Maintain site without emergent or wetland vegetation.
2. Plant bare substrate areas with the accepted seed mix
3. Install nylon or plastic mesh with Mylar or foil strips attached
4. Attach Mylar or foil strips to stakes and install stakes at intervals within the BMP site and utilize scarecrow devices
5. Remove pickleweed that colonizes the BMP's
6. Do not allow water to stand for more than 7 days
7. Do not plant saltgrass; remove existing saltgrass if possible
8. Remove floating debris and dead and floating vegetation mats
9. Ensure that upland ground cover is dense
10. Remove debris piles, wood boards, logs, rocks, woodpiles from upland areas around BMP's
11. Cut upland vegetation between August and February
12. Maintain wetland and emergent vegetation between August and February
13. Close or cover all holes in and around BMP's
14. Install jackrabbit fence around perimeter
15. Do not allow shrub species to be hydroseeded or establish.

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Zeiner, D.C., W.F. Laudenslayer, K.E. Mayer and M. White. 1990. California's Wildlife: Volume 3 Mammals. State of California Department of Fish and Game. Sacramento, California. 407 pp.

Please contact me or Harold Wier at (760)942-5147 if you have any questions regarding this letter.

Very truly yours,

DUDEK & ASSOCIATES, INC.

Brock A. Ortega
Wildlife Biologist

cc: Harold Wier

APPENDIX J:

PROJECT CALENDAR

June 1999

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
6	7	8	9	10 San Diego Water Quality Meeting-Caltrar D 11 D11 Pilot Site Visit	11	12
13	14	15	16	17	18 Quarterly Report Due	19
20	21	22	23	24	25	26
27	28	29 9:00 AM 2:00 PM Quarterly Status District 7 Site Visits	30 Quarterly Status Meeting-D7 Field Trip 9 am to 5 pm. Montgomery Watson Pasadena			

May 1999

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Jul 1999

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

June

10 San Diego Water Quality Meeting-Caltrans D 11

D11 Pilot Site Visit

18 Quarterly Report Due

29 Quarterly Status Meeting #5 at Caltrans District 7 Office, Pasadena, CA--Participants: Caltrans, RBF, Plaintiffs, Mike Barrett, Dean Messer, BCC, MWC.

District 7 Site Visits

30 Quarterly Status Meeting-D7 Field Trip 9 am to 5 pm. Montgomery Watson Pasadena

July 1999

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Jun 1999 (see below)			Aug 1999 (see below)	1	2	3
4	5 HOLIDAY	6	7	8	9	10
11	12 Bi-weekly Report Due	13	14 10:00 AM-Bi Weekly Conference Call--Marcelo Peinado, Bob Wu, Rich Horner, Chris May, Rich Graff, RBF, Jeremy Johnstone.	15 Submit Winter Operations/Mai Cost from BMP Pilot Program	16	17
18	19	20	21	22	23	24
25	26 Bi-weekly Report Due	27	28 10:00 AM-Bi Weekly Conference Call--Marcelo Peinado, Bob Wu, Rich Horner, Chris May, Rich Graff, RBF, Jeremy Johnstone.	29	30	31

Jun 1999

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Aug 1999

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

July

5 HOLIDAY

12 Bi-weekly Report Due

14 10:00 AM-Bi Weekly Conference Call--Marcelo Peinado, Bob Wu, Rich Homer, Chris May, Rich Graff, RBF, Jeremy Johnstone.

15 Submit Winter Operations/Maintenance Cost from BMP Pilot Program

26 Bi-weekly Report Due

28 10:00 AM-Bi Weekly Conference Call--Marcelo Peinado, Bob Wu, Rich Homer, Chris May, Rich Graff, RBF, Jeremy Johnstone.

August 1999

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9 Bi-weekly Report Due	10	11 10:00 AM-Bi Weekly Conference Call--Marcelo Peinado, Bob Wu, Rich Horner, Chris May, Rich Graff, RBF, Jeremy Johnstone.	12	13 Draft OMM Plans to Plaintiffs for review.	14
15	16	17	18	19	20	21
22	23 Bi-weekly Report Due	24	25 10:00 AM-Bi Weekly Conference Call--Marcelo Peinado, Bob Wu, Rich Horner, Chris May, Rich Graff, RBF, Jeremy Johnstone.	26	27 Plaintiff Comments	28
29	30	31				

Jul 1999

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Sep 1999

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

August

9	Bi-weekly Report Due
11	10:00 AM-Bi Weekly Conference Call--Marcelo Peinado, Bob Wu, Rich Horner, Chris May, Rich Graff, RBF, Jeremy Johnstone.
13	Draft OMM Plans to Plaintiffs for review.
23	Bi-weekly Report Due
25	10:00 AM-Bi Weekly Conference Call--Marcelo Peinado, Bob Wu, Rich Horner, Chris May, Rich Graff, RBF, Jeremy Johnstone.
27	Plaintiff Comments

September 1999

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Aug 1999

S	M	T	W	T	F	S
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8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Oct 1999

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					1	2
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10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

October 1999

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Sep 1999

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Nov 1999

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				